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CREATION RESEARCH SOCIETY QUARTERLY

Volume 44 Spring 2008 Number 4

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Articles

Toppling the Timescale
Part II: Unearthing the Cornerstone 256
John K. Reed

Long-Distance Flood Transport of the
Nenana Gravel of Alaska—
Similar to Other Gravels in the United States 264
Michael J. Oard

The Origin of Senescence and Death:
An Evolutionary Enigma 279
Hans Degens

A Hypercane Deposit at Little Stave Creek,
Clarke County, Alabama, USA 286
Carl R. Froede, Jr.

The Heavener Roadcut:
Deltaic Environment or Flood Deposit? 301
Mark W. Allen

The Fungus Fossil Record:
A Major Problem for Darwinism 310
Jerry Bergman

Departments

Editorial: Will the Real Charlie Chaplin…? 253

Letter to the Editor.. 323

Book Reviews

Mabbul by John K. Reed... 255

The Genesis of Germs by Allen Gillen...................... 263

Investigating Evolution:
A Six Part Educational Series 300

The Regulatory Genome: Gene Regulatory
Networks in Development and Evolution
by Eric H. Davidson.. 308

Creation's Sensible Sequence
by John B. Mulder 309

Chance or Purpose? Creation,
Evolution, and a Rational Faith
by Christoph Cardinal Schönborn 324

Notes from the Panorama of Science

Questioning the Origin of Mammals........................ 321

The Fossil Jaw that Could Change Everything.........322

Computers and the Human Mind............................322

Instructions to Authors.. 325

Membership/Subscription Application
and Renewal Form 327

Order Blank for Past Issues... 328

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Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh.—Exodus 20:11

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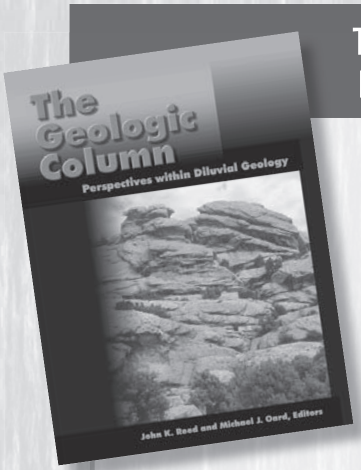
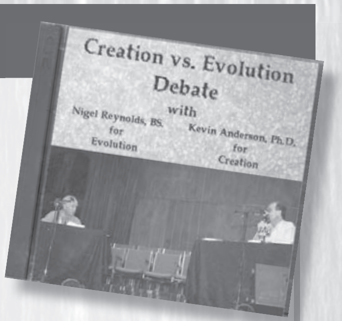

The Geologic Column
Perspectives within Diluvial Geology
John K. Reed and Michael J. Oard, Editors

The Geologic Column: Perspectives within Diluvial Geology

John K. Reed and Michael J. Oard, Editors 2006. Creation Research Society, 157 pages. Regular price: $15.00; Member price: $11.00.

Many wonder how the evolutionary/uniformitarian geologic column fits into diluvial geology. At present, there is a remarkable diversity of original thought on this subject. Recent exchanges in the creationist literature show a tendency for various participants to talk past one another. This book has brought these different perspectives together with two goals: 1) to better define the real differences within diluvial geology, and 2) to identify the concrete issues that will provide a basis for continued research and, hopefully, future resolution. The editors went one step further by providing, at the end of most chapters, a forum with comments and responses. In addition to the editors, the other authors are: Terry Mortenson, Peter Klevberg, Carl Froede Jr., David J. Tyler, Harold G. Coffin, and Emil Silvestru. Though it may be difficult to visualize now, diluvial geology represents a major paradigm shift that holds the potential to stimulate a revolution within the earth sciences.

Creation vs. Evolution Debate



2006. Creation Research Society, approx. 45 minutes. Audio CD. Regular price: $10.00; Member price: $8.00.

Dr. Kevin Anderson (director of the Society's Van Andel Creation Research Center) squares off against local Arizona anti-creationist, Nigel Reynolds. The debate features initial arguments by both presenters followed by lively rebuttals, cross-examinations, and audience questions. This debate provides the listener an excellent opportunity to weigh the arguments of each side and seriously consider where the scientific evidence best fits.

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Editorial

Will the Real Charlie Chaplin…?

As the story goes, the famous silent screen comedian Charlie Chaplin once entered a Charlie Chaplin look-alike contest. He won third place. Apparently, the judges determined that someone else looked more like him than he did. Often it seems that we humans are more enamored with our own version of reality than with reality itself.

This was amply demonstrated in a recent poll that found almost 25% of Britons think Winston Churchill was a mythological character, and almost 50% think that the twelfth-century English king, Richard the Lion-Hearted, is merely folklore. In contrast, 58% think that Sherlock Holmes was an actual person.

Aside from a demonstrated huge lack of historical awareness, this reveals a strong tendency of people to evaluate "reality" with a very limited and incomplete knowledge and perspective. This incomplete perspective makes people vulnerable to various claims and anecdotes that they encounter during their life. This is one reason why grossly unhistorical movies such as *JFK* and *The DaVinci Code* were able to influence the thinking of millions of viewers. An incomplete perspective also allows us to create an illusive reality of our own choosing, suiting our own foolishness.

This foolishness makes people vulnerable to distorted or silly views of God, the creation, and the supernatural (Eph. 4:14; 1 Tim. 4:1). God is often viewed as some kind of "cosmic muffin" or grandfather figure. Animals, such as cats, are perceived to possess all kinds of "spiritual insight," and mysterious guiding spirits help us to make life's decisions. The actress Shirley MacLaine's view of her creator led her to eventually declare she was her own creator. Her writings describe her so-called revelation and her somewhat famous "500-mile walk." One can only imagine God's bemused sadness upon looking at a lowly human walking along a beach, loudly declaring that she, not He, is god. Another popular creator replacement, even among some noted scientists, is "Mother Earth" (sometimes called Gaia). And, of course, the ultimate creator replacement in contemporary society is the claims of so-called evolutionary science.

The Apostle Paul commented on this foolishness by declaring that the presence and existence of God the Creator is obvious to anyone who will simply look with a seeking heart and mind (Rom. 1:19–20). But many people ultimately have no interest in knowing their creator. Rather, they invent an alternate reality. This reality replaces the true Creator with a creator of their own fantasy (Rom. 1:21–23). Once their own imaginary creator is in place, there are no longer standards of conduct, behavior, or thinking, except what our sinful nature desires. This is often a classic identifier of fake gods; they pull people down to their lowest carnal desire rather than lift them up to a calling beyond their natural weaknesses.

The tragedy this creates is immeasurable. People's behavior stems from their own version of their creator and the reality that perception provides. An uncaring/indifferent creator (e.g., nature) tends to lead to a life of hopelessness and futility. A violent creator will inevitably produce violent followers. A creator that is petty and lustful produces followers of the same attitude. In a previous editorial, following the Virginia Tech shootings, I predicted that because we as a society no longer know our Creator, we would see an increase, not a decrease, of these types of shootings. Regretfully, less than one year later, my prediction is already apparently being fulfilled.

Ultimately, people's behavior can be directly linked to their view of origins. Yet, most people approach origins with a

> This reveals a strong tendency of people to evaluate "reality" with a very limited and incomplete knowledge and perspective.

certain level of unconcern and even apathy. In fact, even a number of professing Christians have failed to understand the relationship of our "origins view" with our conduct. Too many times the pulpit is silent on this. Too many times I get correspondence from those asking what difference it makes. Too many times the Creation Research Society is looked upon as some type of embarrassment by the so-called Christian intellectuals. And, too many times well-meaning Christians shrug their shoulders with indifference while at the same time asking God why people shoot each other, why diseases kill thousands, why little children suffer, and why evil seems to be so powerful.

A man named Job also once asked God such questions (e.g., see Job 3). He asked the same questions that we ask today. He sought the same insight that we so desperately desire.

At first glance, it would appear that God's answers are totally irrelevant to Job's questions. Not once does God ever say, "Job, let me explain to you why this has happened." Instead, He gives Job a detailed lesson in creation (Job 38–41).

What does understanding creation have to do with answering Job's "why" questions? Everything! Without understanding creation, we humans do not understand our place in the cosmos. Without understanding creation, we humans do not understand our origin, the most basic of all questions – where did I come from? Without understanding our origin, we cannot grasp answers to any of life's questions of "why" and "how."

In effect, God told Job he was asking the wrong questions. Job was seeking answers to the "why" of creation. God told Job that he first needed to understand the "who" of creation. Job could not understand answers to the "why" questions until he first understood the answer to the "who" question. Once he understood the "who," then he would be prepared and able to understand the "why." In fact, once the "who" is understood, the questions of "why" tend to answer themselves. I would challenge that if God views our basic questions of life in this framework, then we should as well.

What is more, the apostle Paul specifically described Christ as the Creator (Col. 1:15–17). He then expanded on this and provided a short summary of what he had been teaching as he traveled (Col. 1:15–23). He concluded by declaring that the doctrines he just outlined, which specifically included the teachings of creation and Christ as Creator, were the gospel of Christ (Col. 1:23b). Thus, the gospel cannot be truly taught while ignoring the "who" of creation. This is not a side issue or a topic of secondary importance; it is key to the very nature and meaning of the gospel.

The psalmist wrote that "the heavens declare the glory of God" (Ps. 19:1). This is a familiar verse to many. What is less familiar is that the very same psalmist went on to say that there is no place, knowledge, or language that this declaration is not heard (Ps. 19:2–4). This includes the scientific laboratory and all scientific knowledge and language. It also includes the voice of the prophets. How outspoken evolutionist Dr. Kenneth Miller can claim he believes in a creator God and at the same time deny this God left clear, tangible evidence of his role as creator is a complete and utter contradiction to Psalm 19, as well as Paul's description of the gospel (see Miller's *Finding Darwin's God* as an example of his position).

Noted atheist William Provine (1987) offers a rare insight into the inconsistent thinking of those, such as Miller.

> Of course, it is still possible to believe in both modern evolutionary biology and a purposive force, even the Judaeo-Christian God. One can suppose that God started the whole universe or works through the laws of nature (or both). There is no contradiction between this or similar views of God and natural selection. But this view of God is also worthless ... [Such a God] has nothing to do with human morals, answers no prayers, gives no life everlasting, in fact does nothing whatsoever that is detectable. In other words, religion is compatible with modern evolutionary biology … if the religion is effectively indistinguishable from atheism (pp. 51–52).

Provine correctly realizes that a god who is compatible with evolutionary ideology becomes a god restricted to the background, a god that is inconsequential to the creation. He leaves no indication of his presence, and is totally indifferent to the affairs of his creation, which appears to be just fine without him.

Yet pastors and church leaders continue to pay homage to evolutionary thinking and philosophy (e.g., Darwin Sunday). In so doing, they trivialize the creation message, often acting as if it were an embarrassment. Perhaps this explains, at least in part, why the church today is struggling to remain sufficiently relevant or important. With so many pastors and church leaders having lost their way on the issue of origins, they have ultimately found themselves impotent in providing key answers. They have forgotten God's answer to Job. People come to them with "why" questions, but they have forgotten the answer is "who." As Provine observed, what they preach is "effectively indistinguishable from atheism."

This may also give some insight into why a recent survey found that nearly 50% of churchgoers in the United States have changed their denominational affiliation at least once during their lifetimes. Perhaps people are seeking answers that they are not finding. Perhaps the church has become too much fluff and not enough substance. If all a particular local congregation has to offer is fluff, then their membership may be easily enticed by a nearby church that offers even more fluff.

It is time that Christian leaders once again understand who this God is that they claim to worship. It is time they once again understand and teach the gospel of Christ, and not just their own incomplete version or illusion of the gospel. It is time they once again remember and understand the "who" of creation. They need to quit being attracted to the Charlie Chaplin look-alikes.

Kevin Anderson, Ph.D.
Editor
Creation Research Society Quarterly

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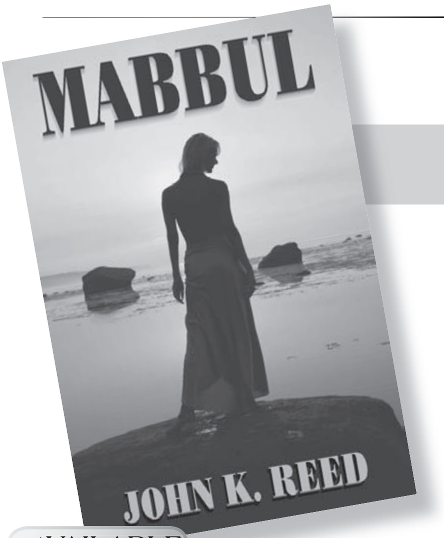

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Book Review

Mabbul

by John K. Reed

Word Ministries, Evans, GA, 2007, 304 pages, $10.00.

Intelligently and creatively written, *Mabbul* offers a unique look at the Genesis Flood. Using the venue of historical fiction, the author creates a vivid and fresh, yet believable, picture of life on the ark. From the time the ark is supernaturally sealed until its inhabitants again are able to walk onto land, *Mabbul* recounts the Genesis Flood in a way that comes alive. The practical challenges that the eight human passengers face include seasickness, depression, boredom, revulsion from the bad smell of animals, and weariness from the weather. The magnitude of the Flood catastrophe is emphasized, with the passengers fearing for their very lives as they face the tempest at the onset and then strive to keep afloat throughout the time the earth is covered with water.

The well-developed characters aboard the ark contribute to a realistic description of the Flood. These are true-to-life people who struggle with their relationships with God as well as other people. Clever ideas about details of the biblical account are spread throughout the book. The reader will be intrigued at the thought of what a marvel the ark truly was in order to function in such a storm and to house so many animals and people for such a long time. In addition, the book depicts a convicting picture of how the human race is naturally sinful; and without a personal relationship with the Creator, we are all slaves to its pervasive evil. Believable situations, realistic characters, and interesting ideas, added to the true event of the Flood, bring this familiar tale to life.

Tasha Oard

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CREATION RESEARCH SOCIETY QUARTERLY

Toppling the Timescale
Part II: Unearthing the Cornerstone

John K. Reed*

Abstract

Creationists have addressed uniformitarianism, evolution, and deep time as foundation blocks of the geological timescale, but have failed to assess its cornerstone. That key principle is the assumption that elements of the rock record represent global correlative synchronous time periods. It is an assumption that dates to the earliest days of modern stratigraphy, but one of questionable value in diluvial geology. Our increasing knowledge of the rock record; of its local variations in tectonic, hydraulic, sedimentary, and diagenetic environments makes it unlikely that globally correlative synchronous time periods can be readily and practically identified in the rocks.

Introduction

Archaeologists patiently sift through layer after layer in search of the foundations of ancient ruins. Investigating long-lived paradigms requires the same persistence; the original ideas are usually obscured by layers of accreted concepts. Such is the geologic timescale. It appears at first glance to be a simple chronology of Earth's history. It can be displayed on one page. However, creationists need to dig deep to its hidden foundations. These are assumptions outside science, like uniformitarianism, evolution, and deep time (Whitcomb and Morris, 1961; Woodmorappe, 1999; Reed and Oard, 2006). But there is one assumption—the "cornerstone" if you will—that deserves extra scrutiny, if for no other reason than that it has been ignored by both uniformitarian and diluvialist scientists for centuries.

This key to the geologic timescale (and modern stratigraphy) is the assumption that rock units can be ordered by reference to concentric layers of synchronous time that are globally correlative. In other words, every rock in the crust can be theoretically assigned a particular age and then correlated with other rocks anywhere on the planet solely on the basis of that age. It is the purpose of this paper to expose that assumption and discuss its past impact and future value for stratigraphy.

The Cornerstone: Global Correlative Synchronous Time

At first glance this idea seems unworthy of intellectual effort; it is too simple. But a little reflection demonstrates that the timescale cannot possibly be true without it. Rocks do not come labeled in the field, and so the fundamental challenge of stratigraphy has always been to correlate the bits and pieces of the crust exposed in outcrop, mines, or wells or measured by acoustic, magnetic, or gravitational properties.

Early stratigraphers acted locally, but thought globally. How could a particular rock unit be correlated to others everywhere on Earth? Today we realize that it cannot be done by lithology, fossils, unconformities, or any other (as yet) known physical property. The pioneers apparently also understood that direct correlation was impossible. It could only be done indirectly—and they chose time as the filter to derive meaning from the jumble of strata.

Since then, there has never been a serious challenge to this decision, probably because every stratigrapher, from creationist to strict uniformitarian, have all agreed on one thing—that the rock record represents history in some fashion. From that conclusion, everyone has made the leap that since rocks are a historical "record," then a

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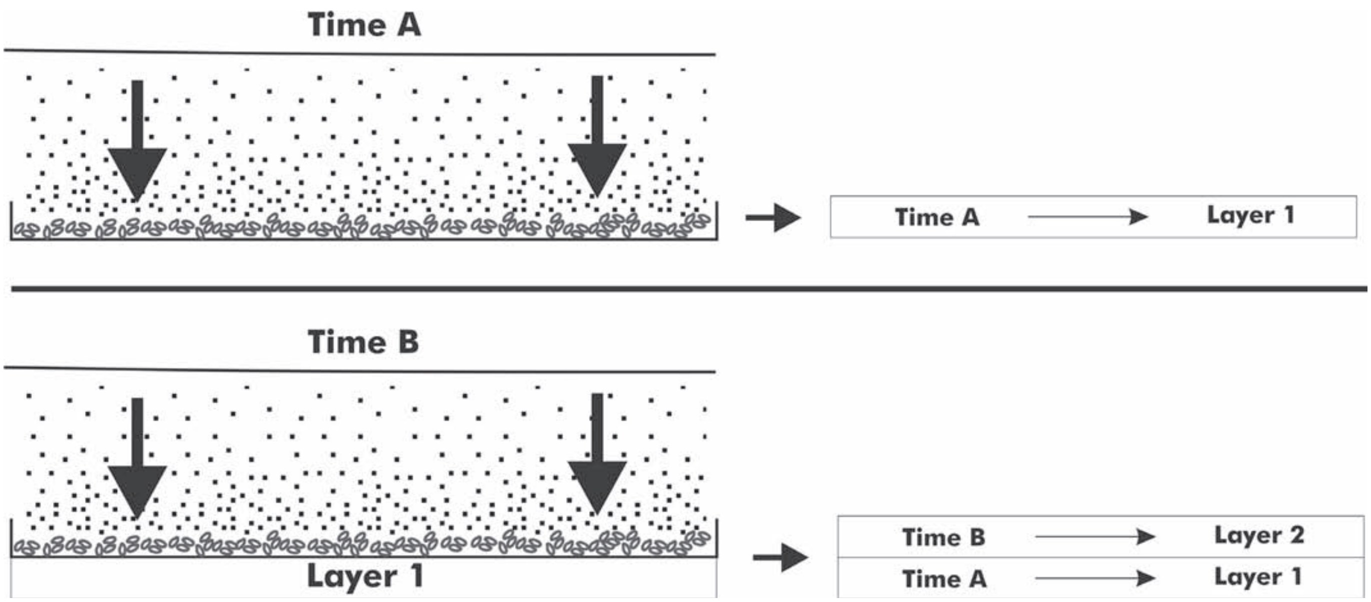

Figure 1. Steno's model of stratigraphic layering. Vertical settling causes the deposition of Layer 1 during Time A. After Layer 1 hardens, the process repeats, forming Layer 2 during Time B. The process continues, over and over, until the sedimentary record is complete—distorted only by erosion and deformation. This concept underlies the modern geologic column.

chronology of layers—like the sequential pages of a book—is not only possible, but necessary. Ergo, the layers are the chronology. Every stratigrapher since Steno has agreed, resulting in the "onion model"—even though rock units are irregular, *stratigraphic* units measure time like the layers of an onion—regular, concentric, and the same everywhere.

In addition to the questionable logic of this arrangement, the effects of scale have been largely ignored and visible sedimentary bedding on the outcrop scale has almost certainly reinforced the idea that strata parallel time, even after exceptions have been demonstrated in the field and the laboratory (Julian et al., 1993; Berthault, 1994). Why has this model been so persistent if problems exist? A quick historical review shows how the assumption was first made and more importantly, how it then quickly vanished below the radar screen.

Origin and Development of the Assumption

Like other axioms of stratigraphy, this assumption can be traced back to Steno. His well-known principal of superposition and his less well-known axioms of "lateral continuity" and "original horizontality" form the framework for the "onion model" that many take for granted today. He believed that sedimentary rocks formed as horizontal layers, which represented discrete periods of time (Figure 1). The logic flowed from that point. Time is a universal constant; its passage is uniform. Thus if time can be correlated to rocks (i.e., today's time-rock units), the succession of strata (absent erosion and non-deposition) would be uniform and could be correlated globally.

> The goal of constructing a single sequence that would have worldwide validity had in fact been present implicitly in much earlier [before the 1830s] descriptions of strata; the general working assumption—it hardly merited the status of a theory—was that there was indeed such a universal sequence to be found (Rudwick, 1985, p. 533, brackets added).

However, if this relationship between rocks and time is not absolute, then modern stratigraphy and its timescale must be reevaluated from the ground up.

Once this theoretical basis was promulgated, early stratigraphers faced several hurdles to implement it. The first was data—too much and too little at the same time. Outcrops, pits, and mine shafts revealed local successions of rock units that were commonly named without consideration for their lateral continuity (or lack of it). The plethora of both rock units and nomenclature demanded simplification. But simplification required systematic information. William Smith [1769–1839] paved the way, gathering and ordering the rock record of England. Using Steno's axioms, he developed a vertical order of strata that he assumed reflected a historical succession, demonstrating that strata from various locales could be ordered by a single vertical template—a timescale.

But there remained a problem. Observed rock units seldom corresponded to cartoon-like layers. So to apply the template of time, stratigraphers needed a key—some non-repeating inherent property that would allow unambiguous labels for sparse or disrupted strata. European stratigraphers first tried lithology, and their initial timescale—*Primary-Secondary-Tertiary*—was based on changes from one rock type to another. By the end of the eighteenth century, geologists realized that lithostratigraphy could not unambiguously define time units. Facies changes, unconformities, diachronism, problems of scale, and the ability of any given lithology to occur in strata of widely varying ages all demanded another approach. Rock units all ended eventually, and the geologists needed to correlate beyond England. Rather than reexamine their assumptions, they kept searching for a "clock." Smith and Cuvier fanned their hope by emphasizing correlation based on lithology combined with fossil assemblages, but by then the direction of stratigraphy was caught up in the raging conflict over history itself. Stratigraphy became a weapon in the fight between Enlightenment secularism and Christianity. As a result, the attempt to order the rock record became an attempt to use the rock record to overthrow the biblical version of ancient history.

In the early 1800s, stratigraphy became a battleground among uniformitarians, old-earth catastrophists, and scriptural geologists. Determined to overthrow the Bible, uniformitarians won, and deep time became a dogma to defend, not a tool of science. The crowning achievement of the uniformitarians was the establishment of a "prehistory" that ripped the majority of Earth's past away from Genesis and made it accessible only to the worldview of naturalism, masked by the new science of geology. As the length of prehistory increased, the relevance of the Bible decreased.

But Ussher had shown that the Bible presented a well-developed chronology as the skeleton of history. Consciously or unconsciously, geologists raced to develop an equally sophisticated system. They did this in two steps. First, they set about to order rock units into a global historical sequence (chronostratigraphy). Second, they assigned absolute dates to those units, creating a global historical chronology. Both steps required the assumption of global correlative synchronous time. Thus, the axiom of global correlative synchronous time periods had become necessary to much more than extended correlation—that assumption became the cornerstone of the emerging uniformitarian worldview.

Two nineteenth-century developments pushed the timescale to its modern form (Figure 2). The first—an ever-expanding chronology—emphasized time boundaries over physical rock properties, and Lyell lived to see the template achieve its modern form. Also, deep time conveniently blurred inconsistencies in correlation. Relationships (mainly diachronous) that might have proven significant puzzles in a short time frame became nothing more than background noise in deep time—especially when the emphasis was so heavily weighted towards driving "golden spikes" to define exact time boundaries.

The second development, the theory of evolution, provided stratigraphers with the reliable chronometer they so desperately sought—index fossils. The irreversible progression of life became the one true clock of stratigraphy—geologists were convinced that evolution's arrow of time would finally order strata globally. Chronostratigraphy was assured, even in areas where physical correlation was impossible. This was because one no longer had to relate physical rock units, only the evolutionary stage of their fossil contents. Ironically, this signaled the end of the search for an empirical key to the rock record—evolutionary successions cannot be observed. Stratigraphers had their solution, but it required a sleight of hand substitution. One could "date" rocks "empirically" by index fossils, but only if the unobserved evolutionary stages were real. The resulting circular argument that fossils "prove" evolution has ironically given modern creationists a potent argument against evolution. To this day, most stratigraphers (who are specialists) believe their work is empirical. Once they find a particular fossil or suite of fossils, they can plug the formation into the "empirically-established" timescale and correlate it across the planet.

The leap from correlating rocks to correlating time periods was a brilliant (though flawed) conceptual shortcut. It provided the means to evade empirical problems created by limited observation, incomplete sections, facies changes, unconformities, deformation, and problems of scale. It relieved geologists of having to perform time-consuming, backbreaking inductive evaluations of every locale. Although the column is presented as an *inductive* culmination of decades of observation, in retrospect, it always has been a *deductive* template—as demonstrated by the failure to use field research to assess its primary (and now sacrosanct) axiom—global correlative synchronous time. Instead, the timescale imprints itself on the local stratigraphy of any new area—assigning ages, unconformities, and correlations. If the template is correct, its shortcuts are beneficial. But what if it is not?

Creationists question the timescale because they reject evolution, deep time, and uniformitarianism. But they have not yet delved deeply enough. Toppling the timescale requires that its cornerstone be uprooted. *If the assumption that rock units represent globally correlative synchronous time periods is not correct, then neither is the timescale.*

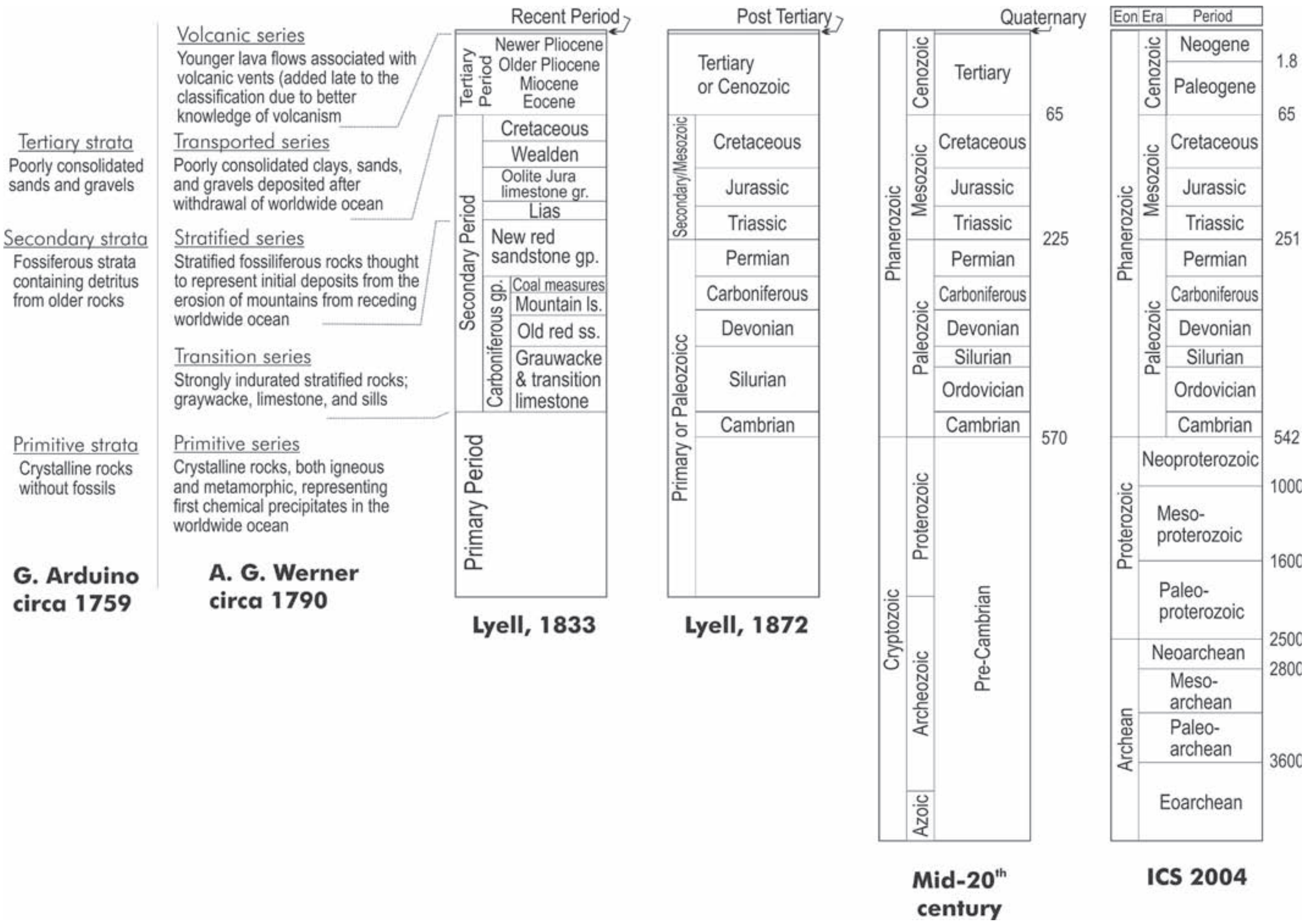

Figure 2. Development of geologic column from eighteenth to twenty-first century. Note transition from a vertical succession of *rock* units to a vertical succession of *time* units during nineteenth century. Modified from Gradstein et al. (2004).

In that case, geologists—like centuries of Ptolemaic astronomers—have been seriously misinterpreting their observations.

Cracks in the Cornerstone

Any challenge to any long-accepted and unrecognized assumption will generate significant misunderstanding. So we must be clear about what is not being challenged. First, at given scales, rock units certainly can be identified and correlated. Second, the succession of particular rock units at a given scale most likely represents the passage of time. The primary error lies in the unwarranted extrapolation of *local* observation to *global* scale. Like Plato's forms, we see the imperfect reality in an outcrop and intuit an ethereal, ideal column. This extrapolation is dual—across space (e.g., from Britain to Bangladesh) and from space to time (e.g., rock unit A = time unit A). Even in the initial "Primary-Secondary-Tertiary" framework, these leaps were beginning to be made.

But the reasoning is circular. If the timescale (as a template) is used to decipher a given outcrop, it is invalid to then say that the same outcrop "proves" the timescale. One of the greatest barriers to fruitful discussion is that stratigraphers continue to assume that they can jump from physical rock to abstract time and be doing something empirical. When the timescale is questioned, they point to the physical rock—"This is Jurassic!"—in response. If someone is impertinent enough to point out that that particular rock unit ends a few miles away, they respond by noting that the Jurassic time period was global. Like evolution and index fossils, the argument is circular. However, as long as everyone assumes the validity of globally correlative synchronous time periods, that circularity vanishes in the intellectual fog of a shared assumption.

Modern research has increasingly demonstrated that physical rock units are not regular concentric global layers. They are usually found filling sedimentary basins, and though some of the basins are quite large, they are by no means global. There is no doubt that in particular locations and particular scales, strata occur in vertical successions that represent some passage of time. However, time is not the only factor; time is not necessarily the most important factor; and the leap from rock units to globally correlative time intervals is a leap far out of the empirical realm. There are three reasons why the assumption should be questioned by diluvialists.

A Presuppositional Error

Errors can be divided into three categories: (1) empirical, (2) logical, and (3) presuppositional. Faulty observation may be corrected by additional examination. Faulty reasoning may be corrected by critical evaluation. However, presuppositional errors tend to be both pervasive and resistant to correction. The axiom of globally correlative synchronous time as a template for stratigraphic interpretation is ubiquitous yet never discussed, much less critically evaluated. It finds support among parties as diverse as creationists and uniformitarians. When everyone believes the same tenet, it becomes virtually immune from critical evaluation. For example, all of Tycho Brahe's careful astronomical observations were directed to an incorrect conclusion, simply because he started with the assumption of geocentrism… yet Brahe was no less exacting and careful a scientist than any modern stratigrapher!

Increasing Knowledge of the Rocks

Pioneers of stratigraphy up to the late nineteenth century might be excused for envisioning a "layer-cake" model of Earth's crust. After all, Smith showed that much of England's rock record was a vertical succession of strata. Nothing could have been more obvious than connecting the outcrops and equating the resulting layers with a historical succession. However, the explosion of empirical data and sophisticated investigative tools leaves modern geologists with less excuse; the three dimensional complexity in both geometry and composition of rock bodies is well documented over most of the continents and even to an extent in the ocean basins. And the resulting picture looks less and less like the textbook cartoon. No informed geologist believes that *rock* units are global regular concentric layers; they understand that deposition often has a stronger lateral component than a vertical one. So why do they cling to the assumption that the best interpretive template is that of globally correlative synchronous time?

Instead of reexamining the premise of time-rock equivalence, geologists have always preferred to deal with "problems" in the rock record by multiplying inexact criteria to set time-stratigraphic boundaries. When lithology did not work, they tried fossil assemblages. When those proved inexact, they developed the concept of index fossils. Because index fossils are not foolproof, modern stratigraphers supplement them with isotopic dates, magnetic polarity zones, or chemical markers that supposedly reflect astronomical cycles—each with its own set of shortcomings. They assume that a plethora of inexact methods will provide exact answers, apparently not realizing that the only way for this approach to work is if the answer is known in advance! Rather than question whether the inability to derive exact chronometers for the rock record indicates a problem with the assumptions, the uniformitarian obsession with deep time armors the foundation from such inquiry. After all, the mania about time boundaries prevented a serious investigation into sedimentary depositional systems until the latter half of the twentieth century. And yet, there is clearly a problem. Increasing skepticism about evolution renders the "fossil clock" obsolete and the multitude of other methods cannot mask their individual empirical failures.

Therefore, the horns of today's stratigraphic dilemma are clear: some locations show well-ordered strata in a clear vertical sequence extending over large areas, while others show inexplicable transitions that render correlation almost impossible. Structural and tectonic boundaries, province changes, facies shifts, differential preservation, and the transition from continental to marine all hinder correlation. But stratigraphers insist on pigeonholing rocks into the same old eras, periods, or stages. It may preserve their history from the chaos of ignorance, but the axiom of interpreting via globally correlative synchronous time periods has put a straitjacket on the rock record. What is worse: not knowing, or being sure of what is wrong?

In addition to increasing empirical complexity, experiments (Berthault, 1994) demonstrated the superiority of a hydraulic emphasis as opposed to temporal. Steno apparently failed to recognize that hydraulic variables could create the appearance of superposition without its reality (Figure 3) by the simultaneous formation of multiple sedimentary horizons. Both diluvialists and neocatastrophists are beginning to apply this knowledge in the field, but neither seems to have reached the point of using that knowledge to question the cornerstone. Perhaps this is due to the fact that a hydraulic approach emphasizes local analysis, while the timescale focuses on universal extrapolation.

Scale

One of the fundamental principles of science is the profound effect of scale. No one denies that changes in scale dramatically shift our perspective, but no one seems to apply that insight to the timescale. Early columns were based on local observations and extrapolated over growing distances. Today's template was set firmly in place with virtually no empirical knowledge of geology outside of Western Europe, and with much of that detail coming from Britain. Since stratigraphy was grounded in the transposition

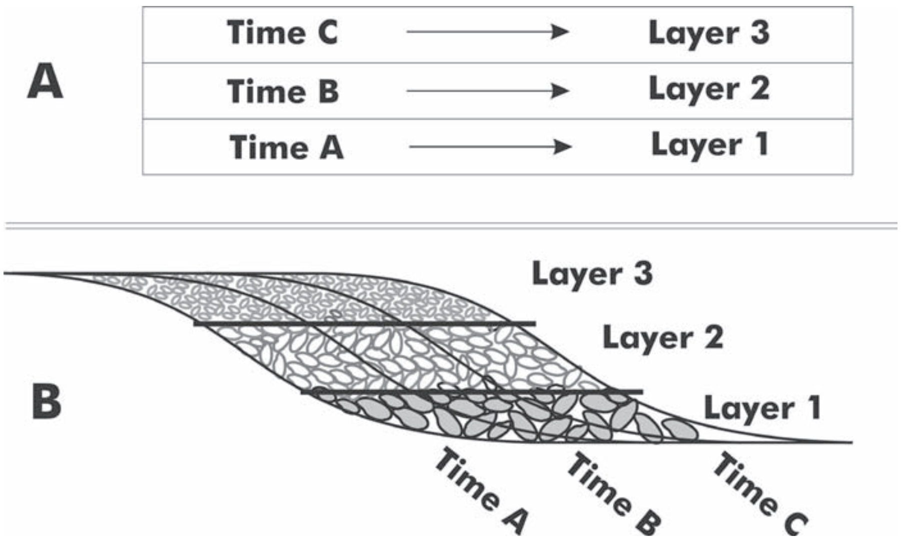

Figure 3. In contrast to the conventional assumption that the rock record was formed by horizontal layering (A), experiments have demonstrated that sedimentary layers and time lines are not parallel (B) when formed by progradation in a moving current. Needless to say, deposition in a Flood model would be heavily weighted to moving currents. Modified from Berthault (1994).

of rock units to time units, geologists "knew" what to expect as they explored elsewhere.

Summary

Stratigraphy rests on the cornerstone of global correlative synchronous time as the template for interpretation. With hardly a thought, empirical rock units are transposed into conceptual time units, and the resulting 4.6 billion-year "prehistory" has hijacked true history. This foundation must be reexamined. It has many inherent weaknesses. Rock units are scale-dependent features, and our increasing knowledge of depositional processes de-emphasizes time at the expense of hydraulics. No one "chronometer" is exact and modern stratigraphers keep switching between methods—fossil zones, astronomical cycles, magnetic polarity chrons, etc.—to mask those weaknesses. Yet no one has bothered to question the one big assumption. Furthermore, the management of the timescale is given into the hands of an elite priesthood, while most geologists turn their energies to tectonic, depositional, and diagenetic histories of local units. Although phenomena are local, interpretation is still presumed to be global. Poor assumptions are retained and their weaknesses are masked by a continuous supply of new methods.

Global Correlative Synchronous Time and Diluvial Geology

The modern resurgence of diluvial geology has challenged the absolute timescale of the geologic column. However, in many cases the critique stops there (e.g., Snelling et al., 1996). Few seem to appreciate that the Genesis Flood, properly understood, challenges the core of the system—the cornerstone of global correlative time "layers." For although the Flood account in Genesis includes a chronology that can be read into Earth's geology (i.e., onset, transgression, highstand, recession, end), there is no guarantee that this chronology will manifest itself globally in similar predictable physical features of rock units. Deposition of rock units in hours or days rather than millions of years; local variations in erosion, tectonism, volcanism, and sedimentation; and even variations in topography (Figure 4) all call for a different approach. The Flood shatters the illusion that time is the key to stratigraphy, focusing attention instead on the effects of widely varying tectonic and hydraulic energy levels on depositional environments.

But even for Flood geologists, it is hard to make such an abrupt shift in stratigraphic paradigms. We have all been heavily influenced by the education, training, and research contexts of our age. Worse, the fact that the offending presupposition has remained hidden so deeply for so long makes it difficult to evaluate the consequences of replacing it. All young-earth geologists reject the geochronology of the timescale, but many seem loath to abandon its global chronostratigraphy (e.g., Tyler and Coffin, 2006). It will be even more difficult to abandon the assumption that makes that chronostratigraphy possible. But at a minimum, we must engage in a critical evaluation of this questionable stratigraphic axiom.

If the rock record cannot be arranged into tidy time periods, then how should we reorder the resulting empirical morass? First, it is worth pointing out that much work has already been done—to the extent that description and environmental/hydraulic interpretation have occurred. Interpretation must begin with a renewed emphasis on empirical stratigraphy (Reed, 2005; Reed et al., 2006). Modern tools and techniques now make it feasible to describe and assess the three-dimensional geometry of many rock bodies. Being able to show rock units in relationship (both laterally and vertically) to each other should be a primary goal of any stratigrapher. Geometry may provide clues to the

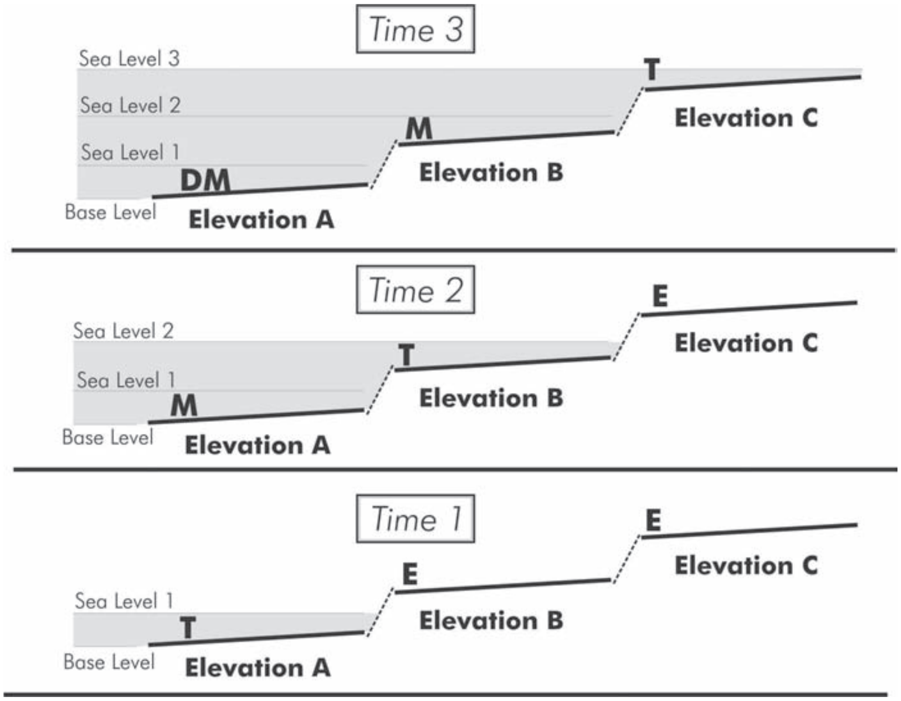

Figure 4. During the Flood, water would have moved laterally across continental landmasses, and the position of those waters with respect to base level would have depended on topographic variation. Since depositional environments would have been determined in part by water depth and energy, any topographic variation would have created differences in geological regimes based on *position*, not *time*, as seen in this hypothetical transgression. Note that abrupt breaks in elevation represent shortening of lateral distances. At Time 1, erosion (E) occurs at higher elevations (B and C), while transgressive deposits (T) cover Elevation A. At Time 2, erosion is restricted to Elevation C, while transgressive deposits move to (B) and marine deposits (M) cover the transgressive deposits at Elevation A. At Time 3, all levels are submerged. Transgressive deposits finally cover Elevation C at the same time that deep marine deposits (DM) are deposited at A. Thus, the large erosional surface and the resulting sedimentary units, T, M, and DM are *not* synchronous. Most modern stratigraphers would correlate the depositional units (T, M, DM) and the erosional hiatus as each representing a discrete synchronous period of time. The scale of the Flood would cause this diachronous relationship in even large-scale sedimentary units.

original depositional conditions. Was the substrate flat or tilted, rough or smooth, stable or tectonically active? What was base level? Steno may have envisioned a simple setting of particles settling into successive layers on an ideal level substrate, but the rock record and the biblical account of the Flood demand a more complex and comprehensive view.

Conclusion

The bulwark of anti-biblical history is the geological timescale—one of the most powerful constructs of our age. Its power rises from the appearance of multiple overlapping independent methods (biostratigraphy, isotopic dating, astronomical cycles, etc.) and voluminous supporting data. But appearances are deceiving. The whole edifice rests upon a questionable cornerstone—the reality of global correlative synchronous time—that has remained unexamined far too long. When viewed from the perspective of the Genesis Flood, this assumption appears to distort the real message of the rock record by focusing on time rather than geologic process. In the clearing away of the detritus of uniformitarianism, let us ensure that we replace its stratigraphic cornerstone with a foundation built on biblical truth.

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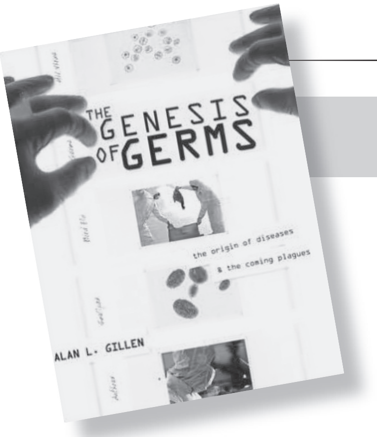

Book Review

The Genesis of Germs

by Allen Gillen

Master Books, Green Forest, AR, 2007, 192 pages, $15.00.

This helpful work provides a foundation for creation writing and thinking on the subject of disease, a fruitful area of study for creationist scholars. Author Gillen, professor of biology at Liberty University, explores the biological and biblical basis for disease in a manner that is informative and understandable to the average reader, while providing details that will interest the most well informed students of pathology.

Gillen begins by exploring the microbial world in this well-illustrated book. He explains that most microbes are helpful, or at least not harmful, to larger organisms, introducing Joseph Francis's creation concept of microbes as a "substrate" for macroscopic life to exist. Diseases are not part of the original creation but appear to be the result of harmful mutations and other changes since the Fall that have turned symbiotic microbes and free-living microorganisms into disease-inducing parasites. Still, most microbes retain most or all of their original functions, helping maintain the ecosystem and supplying humans and other life with necessary nutrients.

Interwoven throughout the book are interesting case studies in the history of disease research, with an emphasis on antievolutionary scientists such as Sir Ernest Chain, the Nobel-winning penicillin researcher. Biblical references to diseases are also covered, including a concluding section on the coming plagues associated with the book of Revelation.

One interesting topic discussed is the past optimism that disease could be conquered, contrasted with the current reality that numerous new diseases are appearing among mankind. The rapid development of new diseases supports the conclusion of John Woodmorappe (1996) that disease could have developed almost entirely after the Flood cataclysm. Noah did not have to harbor all known modern diseases aboard the ark!

One area that could have been more strongly developed is the thesis that antibiotic resistance and similar phenomena are not the result of innovative mutations, as evolutionists commonly allege. Instead, cases of resistance appear to be either preexisting or due to neutral, iterative variations, or the fluke side effect of degenerative mutations. Gillen does provide references that touch on this subject, but the penetrating analysis of Lee Spetner (1997) and the various reports of Carl Wieland (1994, 1998) on this subject are overlooked.

The book includes an appendix on bacterial genetics, a multiple choice question section for each chapter, a glossary, and an index.

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Long-Distance Flood Transport of the Nenana Gravel of Alaska—Similar to Other Gravels in the United States

Michael J. Oard*

Abstract

The origin and significance of the Nenana Gravel north of the Alaska Range is documented. The Nenana Gravel possesses similarities to other coarse gravels studied in the western United States, and even from the Appalachian Mountains. The long-distance transport of these gravels would have required large currents of high flow velocities. The necessity of such currents challenges uniformitarian explanations and is more readily explained within a Flood paradigm, mainly the Recessive Stage of the Flood.

Introduction

It is common to find coarse gravel, defined as gravel, cobbles, and boulders, transported long distances away from mountain ranges (Oard, in press). This coarse gravel is commonly rounded to well-rounded, indicating the transporting agent was mostly water. Various types of mass flow could have been involved during part of the transport, especially when first eroded from the mountains.

This paper will document the long-distance transport of coarse gravel north of the Alaska Range and show that it is similar to far-traveled coarse gravel away from other mountain ranges in the lower 48 states.

The Alaska Range

Alaska is considered a mosaic of tectonic terranes assembled by plate tectonic collisions (Muhs et al., 1987). The Alaska Range (Figure 1) is an arc-shaped, generally east-west trending mountain range 600 miles (965 km) long in southern Alaska that merges with the Wrangell and St. Elias Mountains on the southeast and the Aleutian Range on the southwest (Wahrhaftig, 1958). The Denali fault system runs parallel to the mountains of the Alaska Range and is 750 miles (1,200 km) long. The mountains are believed to have started uplifting from a land of low relief in the late Cenozoic about 5 to 6 million years ago, based on apatite fission track thermochronology and "geologic constraints" from basins to the north, such as the Nenana Basin, and to the south, at Cook Inlet (Fitzgerald et al., 1995). Thus, the Alaska Range is "young" within the uniformitarian paradigm.

The highest mountain in North America, Denali (formerly Mount McKinley) at 20,315 ft (6,194 m) above sea level (asl), lies within the western Alaska Range. Most mountains in the Alaska Range are much lower, with their crests averaging between 7,000 and 9,000 ft (2,135 and 2,745 m) asl.

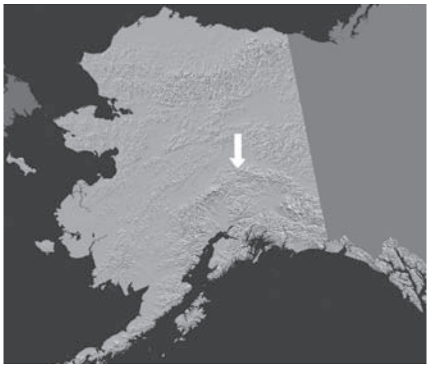

Figure 1. Shaded relief map of Alaska. The Alaska Range (arrow) is the arc-shaped mountain range that extends from southwest Cook inlet to near the Alaska-Canadian border. (From U. S. Geological Survey.)

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The lowlands north and south of the Alaska Range are relatively low. The Tanana Basin to the north is a broad, swampy lowland with average elevations between 395 to 820 ft (120 and 250 m) asl (Bemis, 2004). These basins likely were caused by the subsidence associated with the uplift of the Alaska Range (Thoms, 2000).

Gravels

Coarse Gravel North of Alaska Range

Before the uplift of the Alaska Range, the Usibelli Group, consisting of five poorly consolidated formations, was deposited during the Oligocene and Miocene (mid to late Cenozoic) of the uniformitarian timescale. The Usibelli Group is about 1,965 ft (600 m) thick and consists of pebbly sandstone interbedded with coal and mudstone. Paleocurrent directions have been determined, especially from planar and trough crossbeds in sandstones and imbrication of oblong rocks in the gravel. They show south to southwest flowing paleocurrents (Bemis, 2004; Ridgeway et al., 1999). The Usibelli Group likely eroded from the Yukon-Tanana Terrane to the north and east.

The Nenana Gravel was deposited over the Usibelli Group, and the two units are separated by a "paraconformity," a postulated unconformity that shows no evidence of past erosion, over an area of 5,400 mi^2 (14,000 km^2) [Thoms, 2000]. Figure 2 shows the area of the current outcrops of the Nenana Gravel and their measured paleocurrent directions just north of the Alaska Range. The gravel, deposited in basins just north of the Alaska Range, is massive to thick-bedded, poorly consolidated, and well sorted (Bemis, 2004) (Figure 3). It is up to about 3,935 ft (1,200 m) thick at its type section east of Healy, which is on the main highway linking Anchorage to Fairbanks. The gravel thins northward to about 1,640 ft (500 m) just north of the Alaska Range foothills.

The coarse gravel consists of a wide variety of rock types. The lower part of the Nenana Gravel is dominated by sandstone, conglomerate, and volcanic rocks, while higher in the formation, plutonic and greenstone (metamorphosed basalt) clasts predominate. The different lithologies help reconstruct the depositional history. The lower Nenana Gravel was derived from sedimentary basins south of the Alaska Range. As the Alaska Range began to be uplifted, its igneous roots were unroofed, and the upper Nenana Gravels reflect those lithologies. Also, there was a drainage reversal: the southward flowing currents

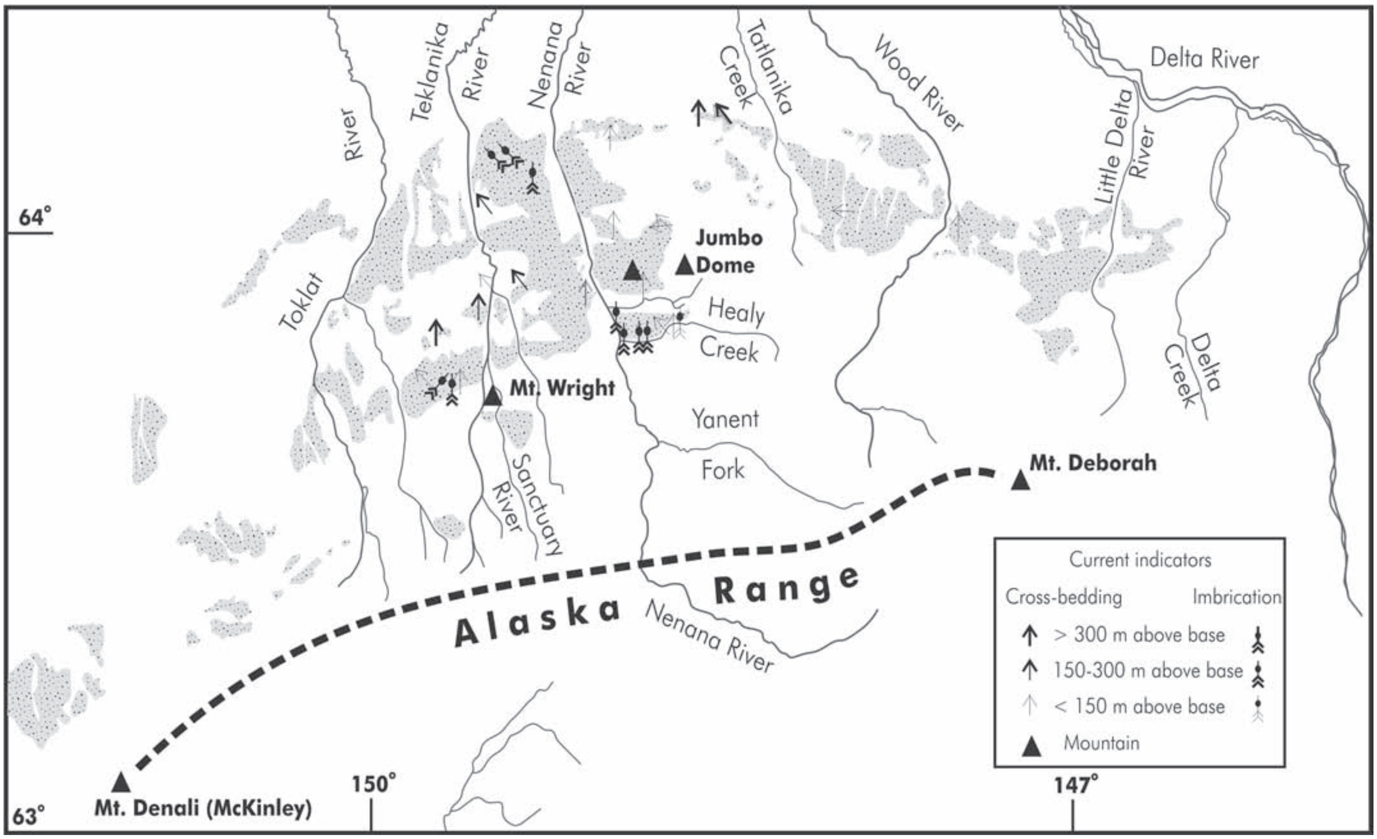


Figure 2. Map of the Nenana Gravel outcrops with paleocurrent directions. Modified from Thom (2000, p. 31).

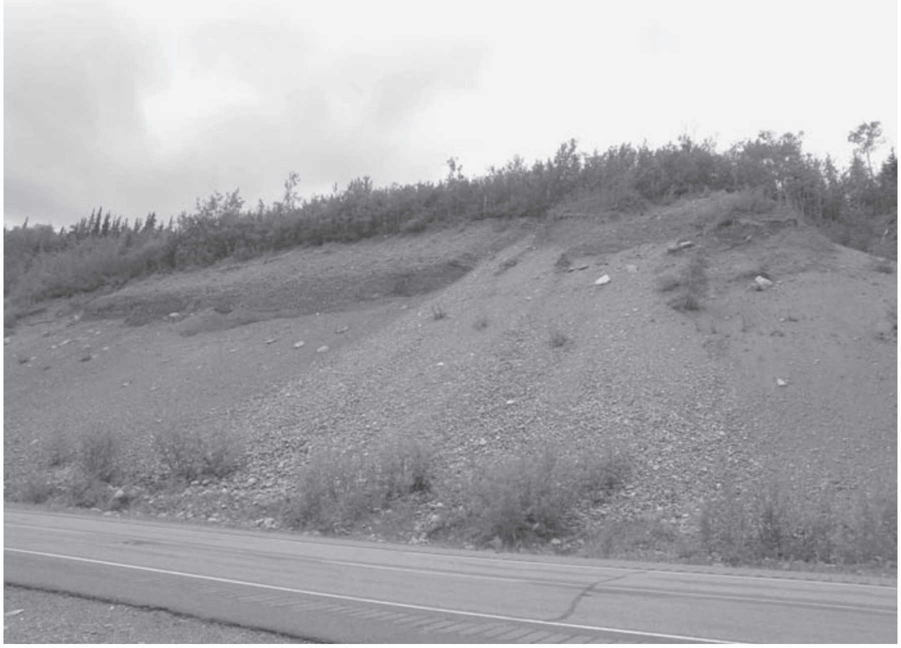


Figure 3. Bedded Nenana Gravel in road cut about 10 miles north of Healy.

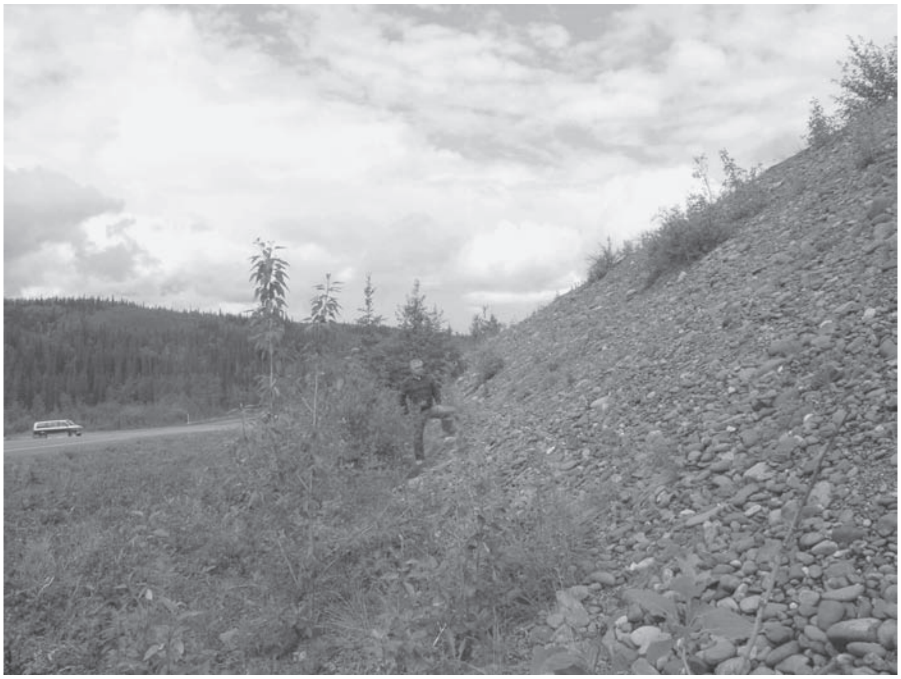


Figure 4. Nenana Gravel about 3 miles north of Healy. Individual in center background provides scale.

of the Usibelli Group changed to northward flowing water during deposition of the Nenana Gravel (Ridgeway et al., 1999). The gravels coarsen upward, yet fines northward (Thoms, 2000). They are also rounded to well-rounded (Ridgeway et al., 1999), indicating significant erosional action by water (Figure 4). The average size of the coarse gravel is 0.5 to 3 inches (1 to 8 cm) (Bemis, 2004) with the maximum clast size being nearly 18 inches (0.5 m) [Wahrhaftig and Black, 1958]. The Nenana Gravel contains interbedded sand and silt (Bemis, 2004; Thoms, 2000), with the rocks commonly coated by an iron patina (Wahrhaftig and Black, 1958). The gravel is dated as "Pliocene" (late Cenozoic) within the uniformitarian geological column (Thoms, 2000, p. 23).

The gravel is widespread and thick north of the Alaska Range and can be observed up to 60 miles (95 km) away from the crest of the Alaska Range (Thoms, 2000). As one drives north from Healy to Nenana, the flat surface of the Nenana Gravel becomes covered with loess, wind-blown silt. The gravel continues in the subsurface, as indicated by 2,460 ft (750 m) of Nenana Gravel in a well drilled about 15 miles (25 km) west of the town of Nenana (Thoms, 2000). The gravel is thought to underlie much of the Tanana basin (Thoms, 2000). After deposition, the formation was dissected by generally north-south valleys in which rivers now flow through water gaps (Bemis, 2004).

The Nenana Gravels are interpreted within the uniformitarian paradigm as coalescing alluvial fans and braided stream deposits (Ridgeway et al. 1999; Thoms, 2000). This paleoenvironmental designation is often carelessly applied by uniformitarians to explain sheet-like gravels transported away from mountains. Alluvial fans have a distinctive fan-shaped geomorphology and much of the sedimentation takes place by debris flows, which contain rocks of various shapes and sizes floating in a fine-grained matrix (Miall, 1996). Furthermore, braided streams that also flow on top of alluvial fans generally have a cut-and-fill texture (Miall, 1996). Thus, alluvial fans with braided stream deposits should exhibit rapid facies changes with a chaotic texture, such as observed on top of the Trollheim Fan in Death Valley (Miall, 1996). If the Nenana Gravel is an alluvial fan deposit, there should be a wide variety of angular to rounded rocks within the gravel, but the clasts found in the Nenana are actually rounded to well-rounded!

The morphology of the Nenana Gravel also contradicts the uniformitarian interpretation. When alluvial fans coalesce (a bajada) in front of a mountain range, one would expect that there would still be thicker areas in front of valleys (the fans) and thinner areas between the valleys. Although erosional processes would work to level the surface, the top of coalesced alluvial fans would not be flat but gently undulating in a transect parallel to the mountain range. But the top of the Nenana Gravel is flat (Bemis, 2004), more indicative of watery sheet flow deposition. Even where dissected, the Nenana Gravel forms *flat* or gently northward dipping plateaus and buttes (Thoms, 2000). Such features seem inimical to the uniformitarian paleoenvironmental interpretation.

Northern Rocky Mountain Gravels

The Nenana Gravel joins the list of other widespread, thick gravels that have been transported long distances away from mountain ranges in the lower forty-eight states.

The Rocky Mountains of northwestern Montana and central and northern Idaho, as well as the adjacent Canadian Rockies, are composed of a variety of rocks. One of the hardest is quartzite, but quartzite is a minor proportion of the sedimentary rocks. Quartzite is a very resistant metamorphic rock, formed by the recrystallization of sandstone under elevated heat and generally high pressure, probably caused by rock burial. It makes up about 10% of the Belt Supergroup—an extensive sedimentary deposit in the northern Rocky Mountains (Figure 5). Argillite, a slightly metamorphosed shale, makes up most of the rest of the Belt rocks. Quartzite sources are mostly found near the Montana/Idaho border and in central Idaho.

Well-rounded quartzite cobbles and boulders have been transported hundreds of miles both east and west from their sources in the Rocky Mountains (Hergenrather, 2006; Klevberg and Oard, 1998; Oard, in press; Oard and Klevberg, 1998; Oard et al., 2005; 2006a; 2006b; 2007). These gravel deposits range from as far away as western North Dakota and southwestern Manitoba to the Pacific Ocean! During transport the eroded quartzites were quickly rounded, and the turbulence of flow created percussion marks (semicircular cracks on the face of the clasts)

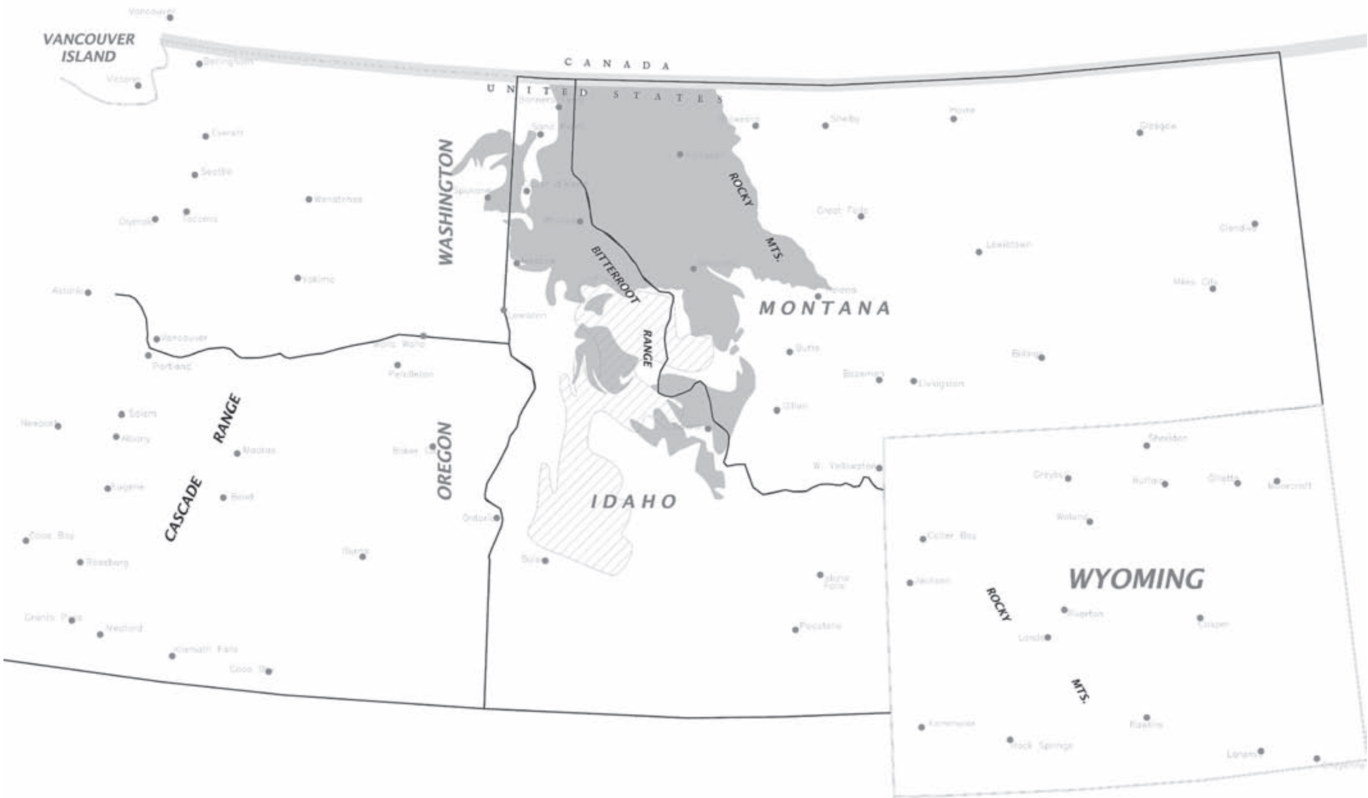
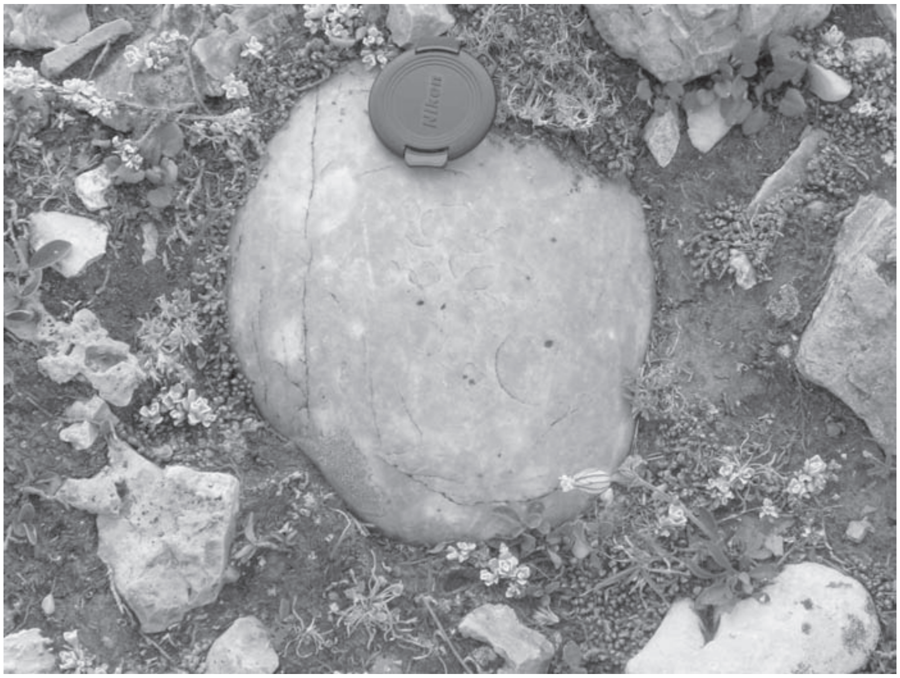
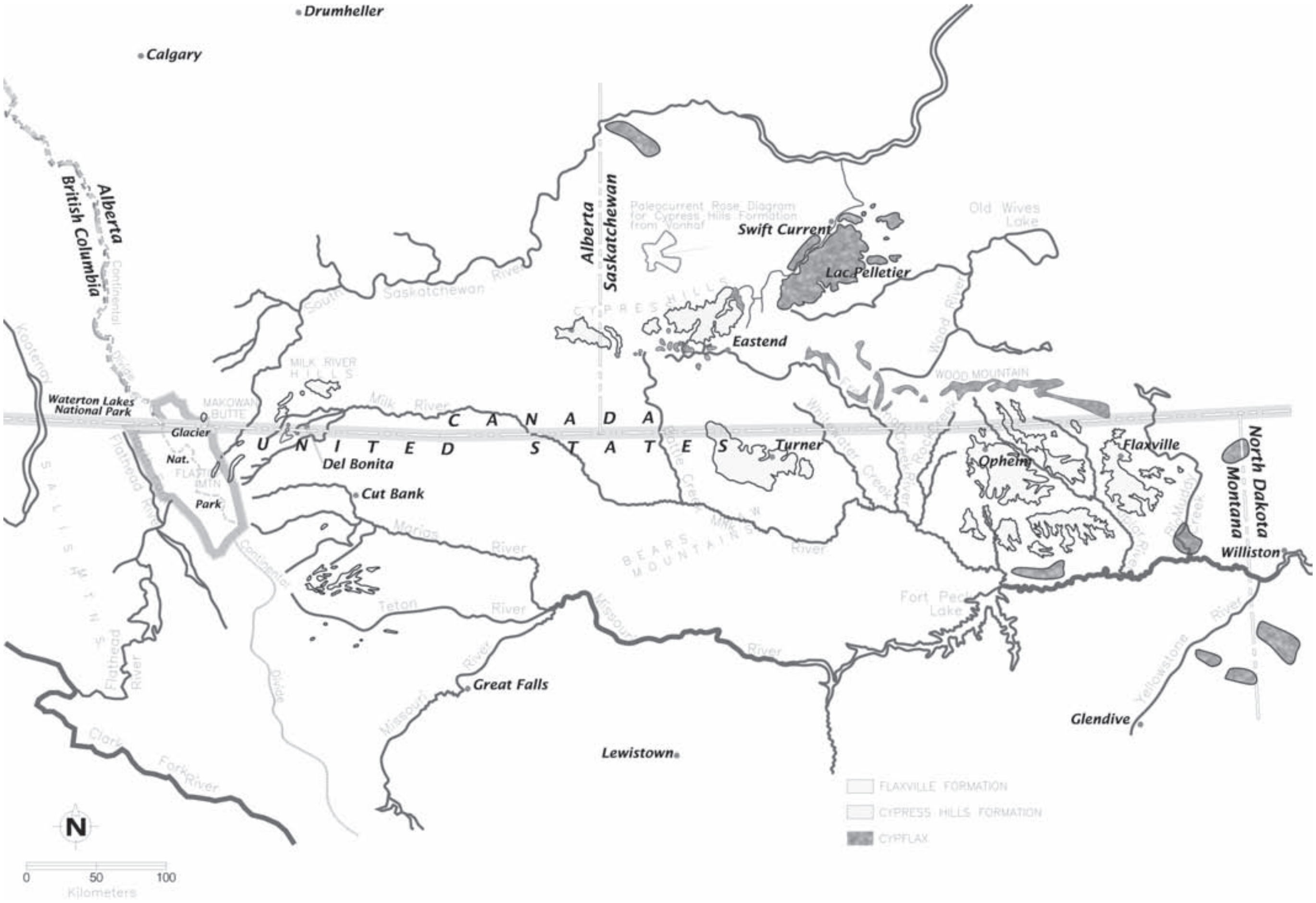


Figure 5. Outcrop of Belt Formation and Idaho Batholith in the northern Rocky Mountains of northwest Montana, north and central Idaho, and northeast Washington. Quartzite makes up about 10% of Belt Formation with the metamorphic grade generally increasing westward.



(left) Figure 6. Percussion marks on a quartzite boulder from the top of Red Mountain, northern Teton Mountains, northwest Wyoming. Lens cap (top center) added for scale.

(below) Figure 7. Locations of rounded quartzite gravel on the plains of northern Montana and adjacent Canada, east of the inferred source area located in the Rocky Mountains. Glacial till covers much of the area including most of the quartzite locations that are in situ. Only the western Cypress Hills and Flaxville plateaus and adjacent Wood Mountain plateau are considered unglaciated. Quartzite also occurs between the in situ outcrops in most of the area and is hardly weathered from the glaciation. Paleocurrent rose diagram (top center) shows west-southwest paleocurrents for the Cypress Hills Formation. Modified from Vonhof (1965).



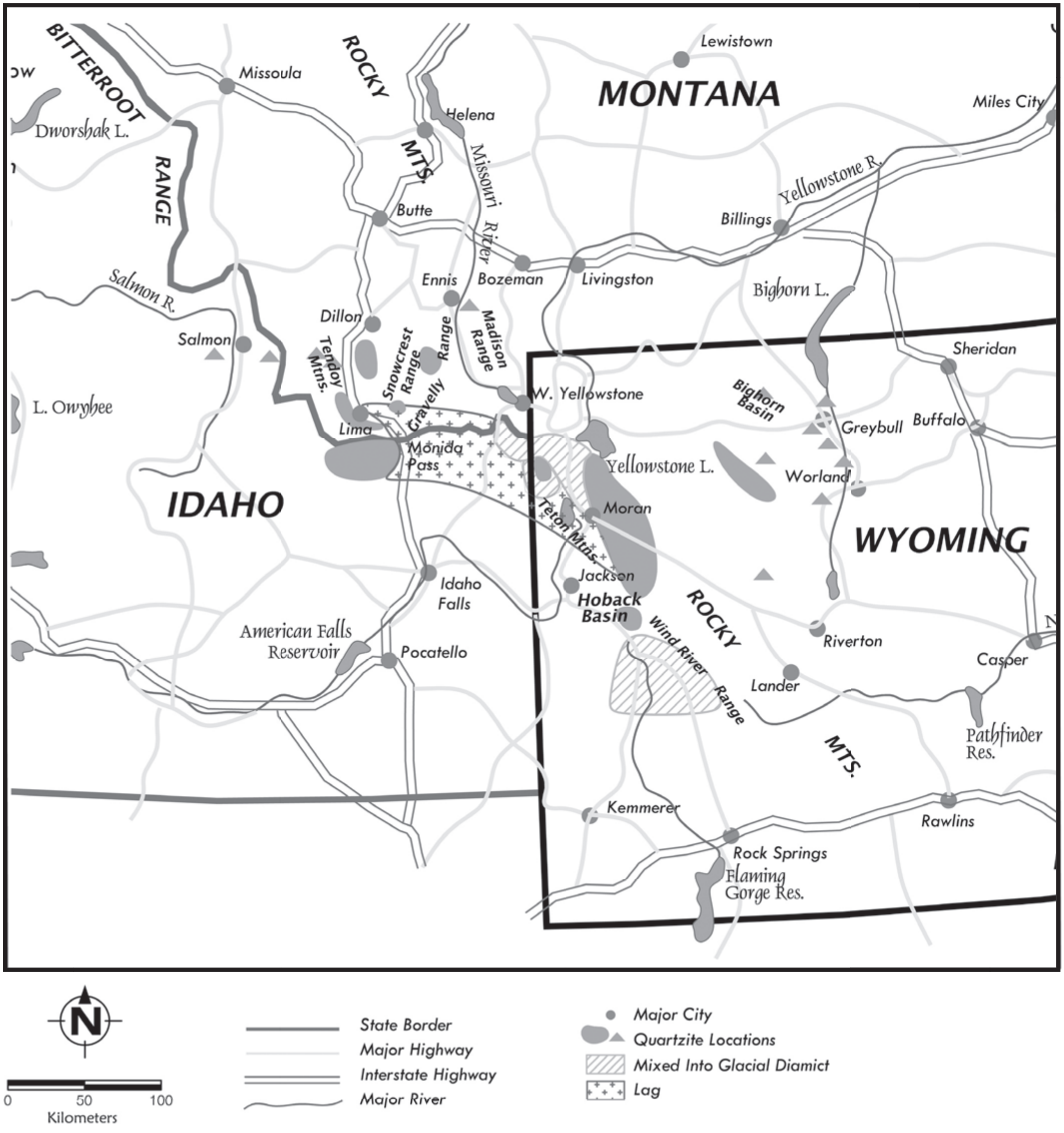


Figure 8. Quartzite gravel locations in southwest Montana, northwest Wyoming, and adjacent Idaho.

on most of the larger quartzite clasts (Figure 6).

Figure 7 shows well-rounded quartzites capping the highest two planation surfaces east of the Rocky Mountains in northern Montana and adjacent Canada. The gravels on the highest plateau are called the Cypress Hills Formation, while those on the lower plateau are called the Flaxville Formation. Since both rock units appear identical, I simply call them the "Cypflax" gravel, despite their different uniformitarian ages (Oligocene vs. early Pleistocene). Intermediate level "Cypflax" gravel

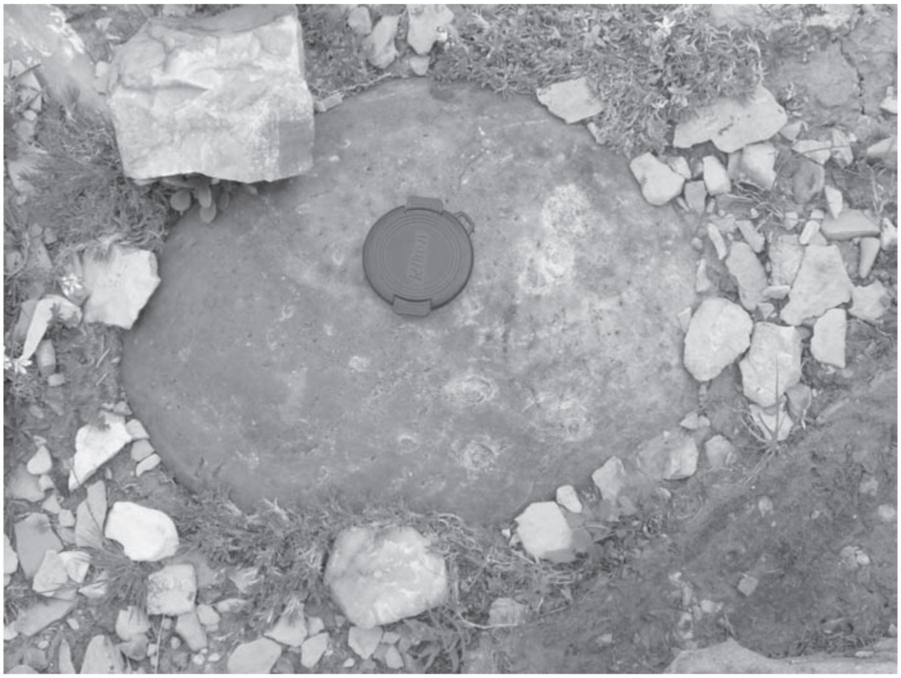


Figure 9. Pressure solution marks on an iron-stained quartzite boulder from the top of Red Mountain, northern Teton Mountains, and northwest Wyoming. Lens cap (center) added for scale.

also is present on the Wood Mountain Plateau, where in situ gravel is as much as 100 ft (30 m) thick (Leckie, 2006). Quartzite gravel is found extensively between and around these plateaus at lower levels, being eroded during the ice age and mixed with other types of rocks. The whole area was likely carpeted with a thin layer of quartzite gravel prior to ice age glaciation. The quartzite gravels beneath the glacial deposits in southern Saskatchewan and southwestern Manitoba are not shown in Figure 7, but are extensive (Whitaker and Christiansen, 1972). They are called the Empress Formation and can be found as far northeast as between Saskatoon and Prince Alberta, Saskatchewan (Dixon Edwards and Scafe, 1996).

Note the rose diagram in the top center of Figure 7. It shows the paleocurrent directions derived from the gravel and its sand interbeds, demonstrating that the quartzite was transported from the west-southwest. A more recent publication shows a direction more from the south-west or even south-southwest (Leckie, 2006). The average is from the southwest. Bedded quartzite layers, such as seen in the Rocky Mountains, do not outcrop on the High Plains, so the water current indicators demonstrate that the quartzites originated in the Rocky Mountains, the closest source to the southwest.

Since the outcrops plotted in Figure 7 are east of the Continental Divide, one would presume that the quartzite was eroded from the east side of the Rocky Mountains. However, the quartzite gravel plotted on Figure 7 is high grade and is found west of the continental divide. Amazingly, these very hard, vitreous, high-grade quartzites on the plateaus of the High Plains originated west of the Continental Divide. According to Leckie and Cheel (1989) and Leckie (2006), the quartzites likely originated from the western Rocky Mountains, generally near the Montana-Idaho border or from central Idaho. That certainly leads to the question of how these rocks were transported over the Continental Divide, and then for hundreds of miles out onto the plains. The uniformitarian explanation fails on several fronts.

Note the scale in the lower left of Figure 7. If the quartzite gravel in extreme eastern Montana and western North Dakota originated from near the North Fork of the Flathead River (shown on Figure 7), then it was transported about 450 miles (720 km) up and over the Continental Divide and down a low slope well out onto the High Plains. However, if the source was in central Idaho, then the quartzites were transported even farther—more than 600 miles (1,000 km). Alden (1932) claimed that these distinctive rocks can be traced as far as 145 miles (230 km) farther east of the northeast corner of Montana along the 49th parallel. This means these quartzite rocks in North Dakota, as well as in southwest Manitoba and between Saskatoon and Prince Albert, Saskatchewan (Dixon Edwards and Scafe, 1996) have been transported at least 745 miles (1,230 km), if their source is central Idaho. Quartzite rocks also have been transported well away from the Rocky Mountains of Canada northeastward into northern and central Alberta (Dixon Edwards and Scafe, 1996).

Quartzite gravel is also extensive in southwestern Montana, northwestern Wyoming, and adjacent parts of Idaho (Figure 8). This is an area of crustal extension causing high mountains and deep paleovalleys that are partially filled with sedimentary rocks and volcanic material. Well-rounded quartzite cobbles and boulders accumulated mainly in deep paleovalleys between the mountain ranges and reach thicknesses of 3 miles (5 km). One of the most interesting locations for these quartzites is on top of Red Mountain, one of two flat-topped mountains (a remnant of a planation surface) in the northern Teton Mountains of northwestern Wyoming (see Figure 6). An especially widespread and thick outcrop of rounded quartzites has accumulated east and northeast of Jack-

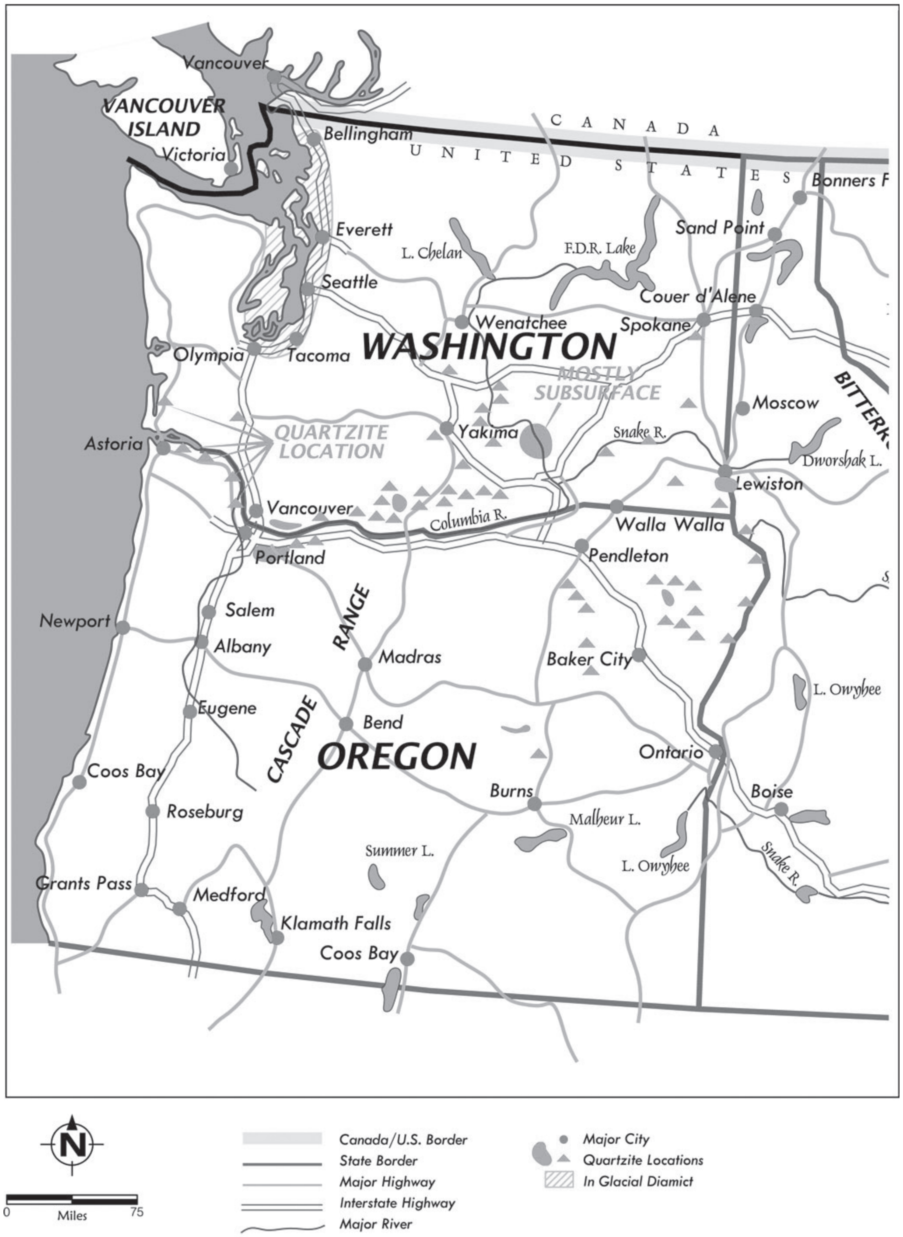


Figure 10. Locations of quartzite gravels in western Idaho, Oregon, and Washington.

son, Wyoming. Love (1973) estimated the original volume as 600 mi^3 (2,500 km^3), but much of it has been eroded since the original deposition (Love, 1973). Burial pressure has fractured and caused pressure solution marks on most of these quartzites (Figure 9). Some of the quartzite boulders in northwest Wyoming are quite large. One in the northern Teton Mountains was measured at 58 inches (1.4 m) long (Love, 1973). Quartzites were transported east into the eastern Bighorn Basin, a distance of about 300 miles (500 km) from their source in Idaho. Love (1960) reported that quartzites were transported all the way to the southwestern Powder River Basin, about 75 miles (120 km) farther east. Thus, the total transport distance from central Idaho is nearly 400 miles (640 km).

Quartzite cobbles and boulders also were transported and deposited west of the Rocky Mountains into Washington and Oregon (Figure 10). There are numerous sites, some that extend as far as the Pacific Ocean, up to 440 miles (700 km) from the nearest source in Idaho (Oard et al., 2006a). The quartzites are found at several locations on top of the Wallowa Mountains. Well-rounded quartzite cobbles, a few with percussion marks, are even found in the Puget Sound area, mixed in with the glacial debris (Mustoe, 2001). One of the most impressive locations for well-rounded quartzite gravel is on top of Gold Hill, about 30 miles (45 km) north of Burns, central Oregon. Gold Hill has an altitude of 6,425 ft (1,959 m) asl. A second location in central Oregon is about 40 miles (60 km) west-northwest of Gold Hill in the Beaver Creek drainage, 9 to 15 miles (15 to 25 km) east of Paulina. These locations in central Oregon make it difficult for uniformitarian scientists to attribute the quartzites to "ancestral" Columbia, Clearwater, Salmon, or Snake Rivers. Well-rounded quartzites are found on every basalt lava ridge in southwest Washington east of the Cascade Mountains up to an altitude of 4,000 ft (1,220 m) on the Horse Heaven Hills.

Arizona Rim Gravels

Although not as laterally extensive as the quartzites spread from the northern Rocky Mountains, large quartzites and other exotic rocks also are found in Arizona (Figure 11). These rocks are the Rim Gravels of the Mogollon Rim in central and northern Arizona, along the southwestern edge of the Colorado Plateau (Oard and Klevberg, 2005). They are often found on the highest terrain of the Mogollon Rim, generally on ridge crests at elevations of 6,900 to 7,900 ft (2,100 to 2,400 m) (Scarborough, 1989).

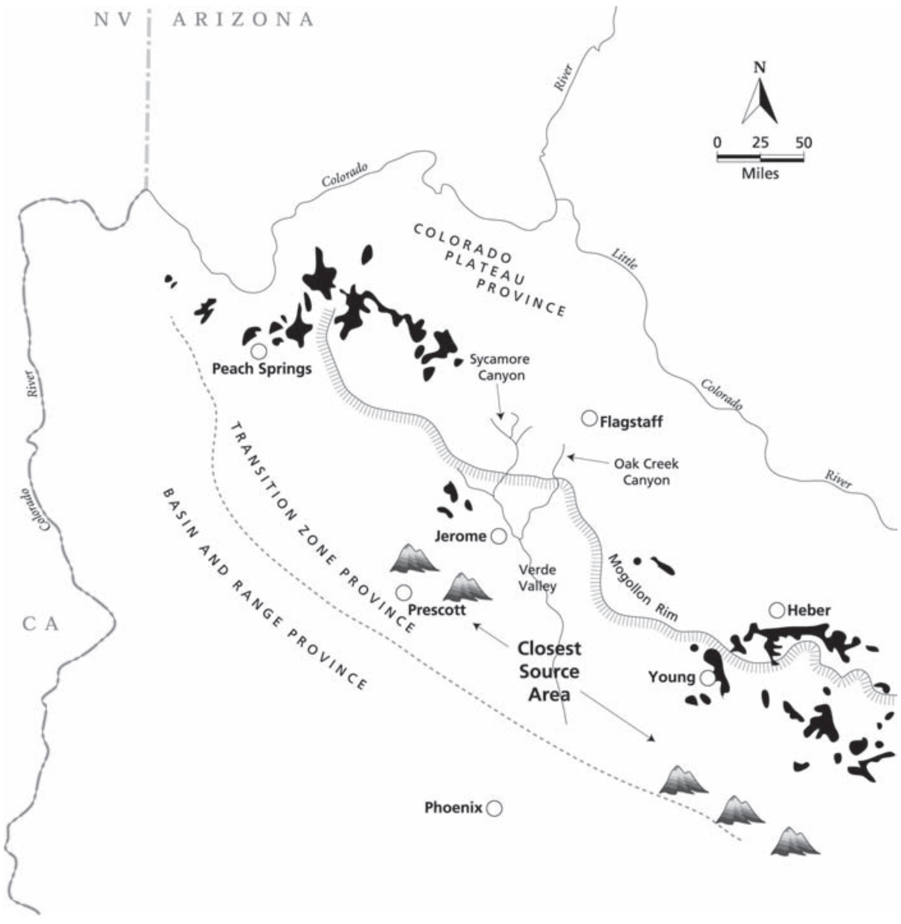


Figure 11. Location of Rim Gravel in Arizona in black. Physiographic provinces of Arizona also are shown. Nearest sources for the Rim Gravel along the northwest and east-central location Mogollon Rim pointed out, but this does not necessarily mean the gravels originated from these locations, since there are many sources to the south and west. Drawn by Mark Wolfe and modified from Elston and Young (1991, Figure 1).

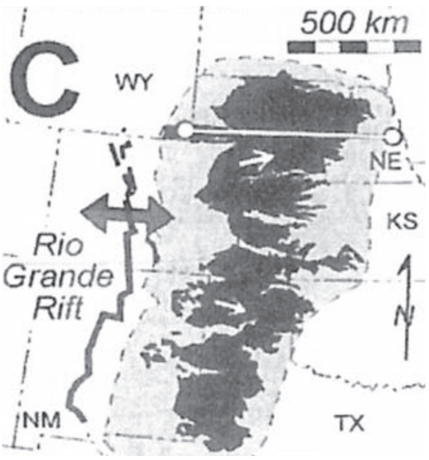


Figure 12. Distribution of the Ogallala Group on the central and southern High Plains of the United States, modified from Thornbury (1965) and Heller et al. (2003). Map shows observed (black) and inferred (shaded) original distribution. White arrows show generalized paleocurrent directions.

The lithology of the gravels varies considerably. There is a significant amount of exotic quartzite. The quartzites observed are well rounded, large, and display percussion marks. The largest quartzite I have personally observed is 24 inches (60 cm) long and 20 inches (50 cm) across, with abundant percussion marks. Along with the exotic rocks, there are also many clasts derived from local "Paleozoic" rocks, especially sandstones.

One of the most amazing characteristics of the Rim Gravels is that current indicators show paleocurrents flowed from areas to the south or west that are now lower than the elevation of the gravels (Elston and Young, 1991; Peirce et al., 1979). The closest source for quartzite and other igneous and metamorphic exotic rocks of the Rim Gravel in the northwest Mogollon Rim is near Prescott, about 50 miles (80 km) to the south (Koons, 1948; 1964). The closest source for the east-central Rim Gravel is a short distance from the rim, but the rocks could have originated at any number of locations farther south and west, where the exotic lithologies outcrop extensively, especially in the mountain ranges. Clearly, a large erosional event must have occurred over the Basin and Range Province of southwestern Arizona.

The Ogallala Group

An extensive deposit of predominantly sandstone with dispersed interbedded coarse gravel or conglomerate was deposited east of the central and southern Rockies across the High Plains of the United States (Frye et al., 1956; Heller et al., 2003; McMillan et al., 2002; Thornbury, 1965). These sedimentary rocks are the Ogallala Group and are composed of a wide variety of igneous and metamorphic rocks, especially quartzite and vein quartz (Bretz and Horberg, 1949; Swinehart et al., 1985). The thickness of the Ogallala Group ranges from about 800 ft (240 m) to less than 3 ft (1 m). The sand and gravel extend from southern South Dakota into Texas. It was originally more extensive, but erosion has removed part of the unit, especially along the eastern fringe (Figure 12). The present area is around 300,000 mi^2 (768,000 km^2), while the inferred maximum area was 590,000 mi^2 (1.5 million km^2).

Cobbles and boulders of the Ogallala gravel are found in central Texas, generally on top of higher areas, such as interstream divides (Byrd, 1969; 1971). The gravel is not associated with well-developed river terraces. The gravel near Uvalde is found 400 to 1,000 ft (120 to 300 m) above the Rio Grande River, indicating much channelized erosion following Ogallala deposition. Based on the interfluve outcrops in central Texas, the Ogallala gravel has been transported about 500 miles (800 km) from its nearest source in central New Mexico (Byrd, 1971).

Appalachian Mountain Gravels

The long-distance transport of resistant rocks also has occurred on either side of the Appalachian Mountains in the eastern United States. The gravel, often found at the highest elevations, has been given many different names. The resistant gravel west of the Appalachian Mountains is generally called the Lafayette Gravel. It is found in scattered upland locations over a wide area east of the Mississippi River Valley, from the Ohio River in the north into the southern states (Autin et al., 1991; Ehlers, 1996; Thornbury, 1965). The original extent of the gravel is enigmatic, since so much of it has been eroded (Bresnahan and Van Arsdale, 2004). The larger rocks in the gravel are typically iron stained and composed mostly of chert, a form of silica similar to quartzite. Quartzite, sandstone, and vein quartz are minor constituents of this gravel (Note: Vein quartz forms by hydrothermal deposition within cracks in rocks and is generally white colored). The gravels are rounded to subrounded and up to 4 inches (10 cm) in diameter. A significant amount of finer-grained material accompanies the gravel. It appears that a regional sheet of gravel once covered a planation surface (the Lexington Plain) that extended across much of the area west of the Appalachians, in some places even beyond the Mississippi River (Autin et al., 1991; Potter, 1955b; Thornbury, 1965). After deposition of the gravel, the area was dissected by channelized erosion.

The Lafayette Gravel shows paleocurrent directions toward the northwest. According to Ehlers (1996) and Thornbury (1965), the Lafayette Gravel was transported from the Appalachian Mountains westward as far as the Mississippi River. Potter (1955a; 1955b) noted that the sand and some of the rocks in the gravel originated from the Blue Ridge Mountains, while other clasts likely were eroded from local sources. The distance from the Mississippi River in western Kentucky eastward to the Blue Ridge Mountains is about 500 miles (800 km). So, the gravel and finer-grained material has been transported as a sheet a long distance over a low slope.

Resistant gravels also were deposited east of the Appalachian Mountains, and now cap the highest terrain. For instance, a sheet-like deposit of gravel around 25 to 30 ft (7 to 9 m) thick covers approximately 600 mi^2 (1,530 km^2) of the coastal plain of southern Maryland (Schlee, 1957). There are also some isolated upland gravels on the Virginia coastal plain. Upland surfaces near the coast from northeastern Maryland, Delaware, southeastern Pennsylvania, and New Jersey are also covered by the Brandywine and Bryn Mawr Gravels (Owens and Minard, 1979; Pazzaglia, 1993; Stose, 1928).

Sand with quartzite pebbles also has been found south of the Appalachian Mountains in Florida (Froede, 2006). These deposits stretch as far south as the northern Florida Keys, where they are found in the subsurface by drill holes. Such quartzites are widespread and consistently about 1.5 inches (3.8 cm) long with some up to 3 inches (7.7 cm) in their longest dimension. The quartzites appear to have been transported more than 650 miles (1,040 km).

Widespread Gravels Are Common Worldwide

Long-distance transport of resistant rocks as gravels has occurred worldwide from many mountain ranges. Well-rounded boulders up to 3 feet (1 m) in diameter were spread southwest from the Zagros Mountains, Iran, up to 15,000 feet (4,575 m) thick (Oberlander, 1965, pp. 29-36). Conglomerates were shed southward all along the south edge of the Himalaya Mountains and formed the upper Siwalik Formation (Gansser, 1964, p 246). Coarse gravel also was spread south of the Pyrenees Mountains (Riba, 1976). The variables of transport, deposition, and erosion often differ from those described above; lithologies, current velocity, and local tectonics all vary. But there is one common theme; the long-distance transport of gravel is a global theme, much more than would be expected from river erosion over millions of years.

Uniformitarian Challenges

The widespread, thick gravels that show evidence of transport over hundreds of miles in water currents of tremendous velocity in regional-scale sheets presents a serious challenge to the uniformitarian paradigm. Several hypotheses have been invented to explain such observations. For the gravels on the High Plains, uniformitarian scientists have appealed to rivers, either in a confined valley that has since disappeared, or within a very wide braided stream (Leckie, 2006; Vonhof, 1965). However, rivers cannot transport gravels many hundreds of miles from their source unless there is a dramatic gradient to provide sufficient energy to move the larger clasts (Kleverg and Oard, 1998). Another problem for uniformitarians is the evidence of the source existing west of the present continental divide. Erosion, either occurring prior to or simultaneously with the sheet deposition, created four large planation surfaces, finally eroding the plains down to the present elevation of many of the rivers, approximately 2,500 ft (760 m). The uniformitarian scientists do not consider various types of mass flow mechanisms, such as debris flows or hyperconcentrated flows, which may have been significant close to the Rocky Mountains (Klevberg and Oard, 1998).

Recognizing that rivers could not have deposited the cobble and boulders over such distances, a few uniformitarian geologists have proposed that the Sweetgrass Hills and Bears Paw Mountains between the Rocky Mountains and the Cypress Hills and Flaxville Plateaus were uplifted, which would have provided a "northeastward gravel boost" (Leckie and Cheel, 1989). But this hypothesis seems to be nothing more than special pleading. It relies on the gravels first reaching these small mountains, coinciding precisely with their uplift (Oard et al., 2006b). The Sweetgrass Hills are 60 to 90 miles (100-150 km) east of the Rocky Mountains, while the Bears Paw Mountains are 125 miles (200 km) east of the Rockies. Both are relatively small mountain ranges. Any "boost" would have had to push billions of quartzite cobbles and boulders at least several hundred miles farther east. One would expect significant amounts of quartzite boulders and cobbles in these areas, left from the "great gravel boost." There are few high-grade quartzites left around these mountain ranges. Furthermore, if the uplift of these hills provided a gradient "boost," the final gravel deposits should include significant amounts of those local lithologies, but they do not.

There have been four uniformitarian hypotheses invented to account for the huge volume of quartzite gravel transported from central Idaho through southwest Montana and adjacent Idaho into northwest and north central Wyoming (Oard et al., 2006b). Only one is considered viable today: the eastward transport by alluvial fans and/or rivers (Janecke et al, 2000; Lindsey, 1972). Could rivers and local alluvial fans have really transported large quartzites from central Idaho to as far east as Jackson Hole and the Bighorn and Powder River Basins—over 400 miles (640 km)? There is no published quantitative support for this idea. Neither is there any explanation of why the range of local lithologies all along the "paleorivers" is absent in the gravels, which are more than 90% quartzite (Love, 1973). The current altitude of the source area is about the same or even a little lower than that of the final deposits in northwestern Wyoming. Therefore, the present gradient cannot provide the energy needed to move the large clasts over such great distances. If the energy came from the gradient, the source area altitude in central Idaho would have to be over 20,000 ft (6,100 m) high (Klevberg and Oard, 1998).

River transport by some "ancestral" Columbia, Salmon, Clearwater, or Snake River is the suggested mechanism to account for the quartzite gravels in Washington and Oregon (Fecht et al., 1987). These hypothetical rivers have been described as "torrential" flows (Allen, 1991). However, the "ancestral river" hypothesis cannot account for the quartzite gravels found on high ridges on the eastern side of the Cascade Mountains, in the Puget Sound area, or the quartzite boulders found in central Oregon. The regional distribution suggests a regional sheet flow, followed by mountain uplift (carrying quartzite rocks to the tops of mountains), followed by channelized flow and erosion of the gravels into the present-day remnants (Oard et al., 2006b).

Other gravels are also problematic. Byrd (1971, p. 7) stated that the origin of the Ogallala (Uvalde) gravel is a major problem.

> A major problem of origin and history of the Uvalde gravels exists because there is no apparent direct connection between the Uvalde gravels and existing drainage in central Texas. Transportation of gravels of such large size is beyond the competence of existing rivers. No source for such coarse siliceous gravels exists in the major basins of present central Texas streams.

Uniformitarian scientists have known about the Rim Gravel for at least 80 years (Koons, 1948). However, there are conflicting interpretations of the ages and origins of the deposits (Holm, 2001). A tabular-shaped, surficial gravel deposit capping an erosion surface, which was subsequently eroded into erosional remnants, is the simplest explanation yet is singularly difficult to accommodate in any uniformitarian scenario because that style of deposition is not one seen in modern environments.

Ray (1965, p. 22) summarized the relative geological events related to the Lafayette Gravels, and the controversy over their origin.

> Factors causing dissection of the Lexington Plain and deposition of the present high-level gravel deposits have been the subject of much speculation. The terrain now consists of a series of widespread dissected gravel-capped erosional remnants and, near the major stream valleys, gravel-mantled bedrock benches.

Uniformitarian scientists have had considerable trouble understanding the gravels east of the Appalachians. Pazzaglia (1993, p. 1,617) stated:

> The origin, age, and correlation of middle Atlantic upper Coastal Plain and Fall Zone…fluvial deposits, long thought to represent proximal facies of a well-known post-Oligocene marine sequence in the Salisbury Embayment…have challenged geologists for more than a century.

The "fluvial deposits" are represented by the gravels. Since uniformitarian geologists assume a river transported the gravel, they simply consider the deposits as fluvial. That may be a large part of their interpretive problems.

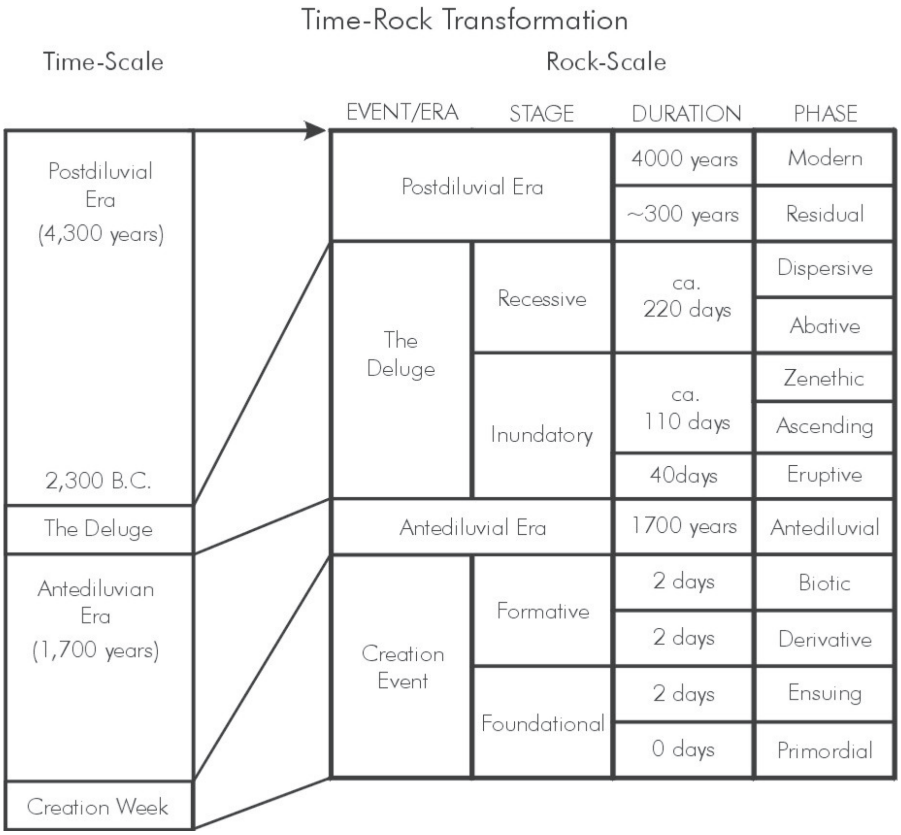


Figure 13. Walker's (1994) biblical geological model (modified by P. Klevberg).

Flood Explanation

The Recessive Stage of the Genesis Flood (Walker, 1994) provides an elegant, simple explanation of all of these gravels, and subsequent erosion. During the Recessive Stage, large-scale currents were moving as sheets, especially on "shallow continents" (Barnette and Baumgardner, 1994). This is called the Abative or Sheet Flow Phase in Walker's (1994) model and resulted in sheet erosion and widespread high-energy deposits (i.e., gravels). Then as more mountains and plateaus emerged, the sheets were transformed into the channels of the Dispersive or Channelized Flow Phase (Figure 13), which would have bisected the gravel sheets.

The energy of the currents is seen in the presence of percussion marks on many of the hard quartzite clasts, especially on those capping the Cypress Hills. It takes a powerful blow to produce a percussion mark on hard quartzite. One possible source of these marks is saltation, a process by which large rocks "bounce" along the bottom of a channel because the current energy is not quite high enough to carry them in suspension. As the rocks are briefly carried upward during fast, turbulent stretches, they then crash back to the bottom, often impacting each other (Klevberg and Oard, 1998). Percussion marks imply turbulent, catastrophic flow. Because of the catastrophic conditions required for their formation, percussion marks rarely form in modern environments.

The velocities of those currents can be calculated by open-channel flow equations used in civil engineering. Percussion marks indicate that small to medium rocks were briefly taken up into suspension in highly turbulent flows (Figure 14). There is a relationship between the horizontal and vertical components of the velocity of rocks falling from suspension, if the maximum rock size can be estimated. It is important to note that estimates of current velocity are of the minimum speed. The minimum current speed required to lift and move a bullet-shaped rock 6 inches (15 cm) across, is over 68 mph (110 kph) with a minimum water depth of 180 ft (55 m). This velocity is about three times faster than the fastest flash floods (Klevberg, 1998; Klevberg and Oard, 1998). It approaches the maximum velocity of water flowing from large dam breaches, such as the one that caused the Lake Missoula flood (Oard, 2004). In addition to these parameters of depth and velocity, the current flowing off the Rocky Mountains must have been hundreds of miles (over 500 km) wide, given the original uneroded extent of the gravels (central Canada to northern Montana). No uniformitarian model can account for such an event. The gravels are powerful evidence for the Flood (Oard et al., 2007).

Furthermore, the Rocky Mountain gravels are not unique. Similar deposits are found all over the world. Erosion of the High Plains of Montana and adjacent Canada indicates that after the Cypress Hills Formation was deposited on its planation surface that subsequent erosion cut the land surface down as much as another 2,500 ft (760 m), forming three more planation surfaces during the process, before cutting the river and stream valleys (Alden, 1932). This sequence of events is what is expected during the Recessional Stage of the Flood (Walker, 1994).

Implications for the Flood/Post-Flood Boundary

Deposition of the gravels and the accompanying erosion occurred late in the uniformitarian timescale—during the "Cenozoic," especially the "late Cenozoic" (Bresnahan and Van Arsdale, 2004; Elston and Young, 1991; Holm, 2001).

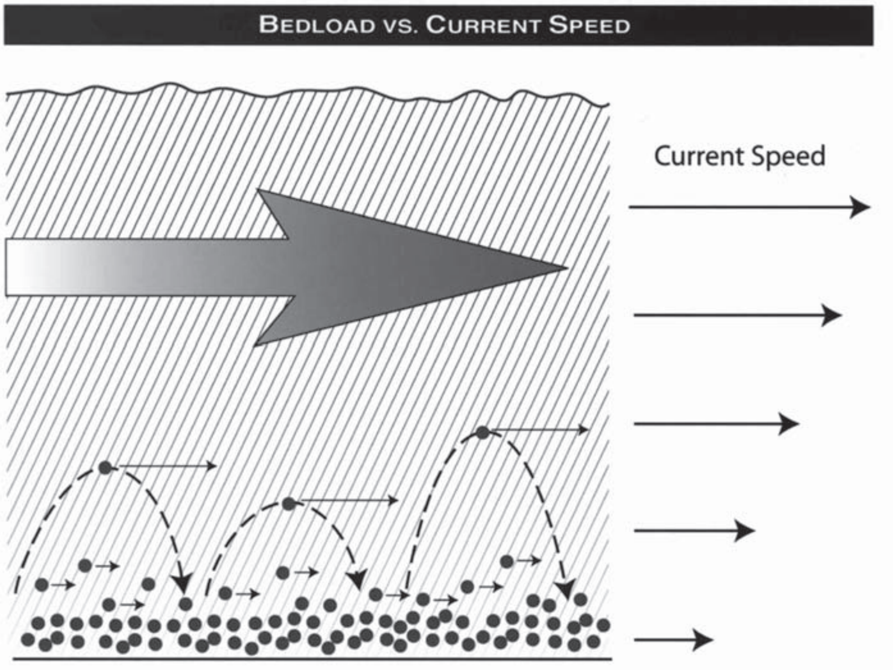


Figure 14. Schematic of turbulent gravel transport in high velocity water. The large rocks are dragged along the bottom as bedload, while the small- to medium-sized rocks are briefly carried up into suspension before crashing back down into the bedload. Drawing by Mark Wolfe.

The evidence strongly suggests that the gravels were deposited during a period of tremendous tectonic activity but while the mountains were still submerged beneath the Floodwaters (Oard, 2001a; 2001b; Psalm 104:5–9). Erosion would have diminished greatly in emergent areas. This implies the rapid vertical uplift of the mountains, probably accompanied by the subsidence of the ocean basins (Oard, in press). Since the gravels and the subsequent channelized erosion would mark the end of the Recessive Stage of the Flood, these events are a good indication of the Flood/post-Flood boundary, regardless of their uniformitarian "age." In many cases, this boundary would be equivalent to the late Cenozoic.

These long-transported coarse gravels are but one criterion that indicates that the Flood/post-Flood boundary is in the late Cenozoic, likely the very latest Cenozoic in most areas (Oard, 2007).

Summary

The widespread, thick, coarse Nenana Gravel adds to the growing list of such gravels that were transported long distances during the late stages of the Flood. No uniformitarian hypothesis has yet come close to explaining the features of these deposits. But, the details of these gravels are easily explained by the Recessional Stage of the Flood (Walker, 1994). Sheet flow eroded the land, forming planation surfaces over broad areas and at multiple levels. Gravel lag deposits were laid down on these surfaces, after having been transported hundreds of miles from their source. Sometimes, the gravel filled deep paleovalleys, such as are found east and northeast of Jackson, Wyoming. Ongoing uplift carried rounded rocks to the tops of mountains, such as the Teton Mountains of northwest Wyoming and the Wallowa Mountains of northeast Oregon.

As more and more mountains and plateaus rose above the Floodwater, channelized flow rapidly carved valleys, canyons, and water gaps. It also eroded the planation surfaces and their gravel caps, leaving scattered remnants of the gravels, often at high elevations on top of plateaus and ridges. The gravels and erosional surfaces are powerful evidence of the work of the global Flood.

Acknowledgements

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The Origin of Senescence and Death: An Evolutionary Enigma

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Abstract

Aging, or senescence, can be described as a reduction in the chance of survival and/or fertility of an organism over time. Senescence is characterized by a decline in organ functions, ultimately resulting in death. This may be caused by many mechanisms, such as inappropriate redistribution of DNA over daughter cells after cell division and accumulation of damage caused by, for instance, chemical radicals over a lifetime. These mechanisms may indeed explain senescence, but they do not explain the origin of senescence and death. Although many evolutionary theories of aging provide explanations for the life history of an organism, they again do not explain the origin of senescence and death per se. Consequently, senescence remains largely an enigma to evolutionary biology. Complete repair of damage and immortality are not impossible. Indeed the germ-cell line is in essence immortal. The existence of single-cell organisms demonstrates immortality indirectly as they give rise to descendants by splitting into two nearly identical daughter cells, and there are even some multicellular organisms that are allegedly immortal. I argue that senescence and mortality are the result of less-than-optimal circumstances causing immortality to become essentially impossible, because extrinsic (from outside the organism) factors will cause death even in the presence of perfect cellular repair mechanisms.

Introduction

Life is something enigmatic; although we generally can determine easily whether or not something is alive or dead, it is still rather difficult to define life. Nevertheless, some unique characteristics exist that distinguish living from nonliving objects, such as the ability to grow and reproduce. Yet, humans and many other organisms live long after their growth and reproductive period has ended. Thus there must be other important features that distinguish life from non-life. One such feature is metabolism: the continuous, simultaneous occurrence of many tightly controlled chemical reactions in a complex interacting network, in which the rate of each individual reaction is controlled adequately to meet the demands of the cell and the whole organism.

While during the initial stages of life there is a progressive development of structures, and organ and reproductive function, during later stages of life the reproductive capacity and organ functions decrease. This decrease in reproductive capacity and organ function is often referred to as aging, a process that ultimately will result in death.

Strictly speaking, the term "aging" describes the passing of time in the lifetime of an object. A better term for the

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process that will be discussed here would be "senescence." However, the term "aging" is so often used in the literature to describe this process that the terms "aging" and "senescence" will be used interchangeably in this paper.

Causes of Senescence and Death

During discussions of senescence and the maximal life span of an organism, it is important to realize the distinction between the ecological and the potential or physiological life span. The ecological life span is defined as the average life expectancy under normal conditions, while the physiological life span is the maximal life span that can be attained under optimal conditions (Prinzinger, 2005). An obvious question is whether death and aging are necessary and inevitable.

Evolutionists have argued that death and aging are programmed and required for evolution (Prinzinger, 2005; von Weizsacker, 1980). The argument is that because of the occurrence of mutations, new organisms may become better adapted to the environment and thus need to replace the older, less-adapted and less fit organisms. Immortality would prevent the replacement of old organisms by new organisms as the niches would already be filled with the older individuals, hence hampering the progress of evolution (Prinzinger, 2005). Consequently, it is thought, selection will occur for aging and death and against any tendency to immortality (von Weizsacker, 1980).

Irrespective of the question of whether or not aging and death are required for evolution, we are confronted with their occurrence as an inevitable, but intuitively paradoxical, part of life. But what is the mechanism behind aging and death? Many theories of aging exist that are not necessarily exclusive of each other (Prinzinger, 2005; Troen, 2003). A few are discussed in some detail before discussing the evolutionary theories of the origin of aging and death and what they actually do explain or fail to explain.

Theory of maximum metabolic scope

According to the theory of the maximum metabolic scope, the physiological life span of an organism is determined by the absolute amount of energy that can be generated per gram of body mass (Prinzinger, 2005). At first glance this might appear surprising, but the relation between physiological life span and body mass is confirmed in a wide variety of species with widely varying body masses, where species with a low body mass are short-lived and species with a large body mass are long-lived. Indeed, the physiological life span largely can be predicted by the following equation:

$$A = aM^{0.25}$$

where A is the physiological life span; a is a constant and M is body mass. It is intriguing that the mass specific energy metabolism (S) follows the inverse pattern with an identical, but negative, exponent:

$$S = bM^{-0.25}$$

where b is a constant and M again is body mass. This relation indicates that the energy metabolic rate per gram of body mass decreases with increasing body mass (Prinzinger, 2005). Applying the above equations, the shorter life span of the mouse than that of the elephant should be related to a higher mass-specific energy metabolism in the mouse. That this indeed is the case is reflected by the much higher heart rate of the mouse than that of the elephant. Furthermore, if the theory of maximum metabolic scope is true, then animals with a lower metabolic rate should live longer than predicted by the above equation. In line with this suggestion is the observation that tortoises, which have a lower metabolic rate than mammals with a comparable body mass, have a longer physiological life span. Similarly, mammals that hibernate have a longer physiological life span than mammals of comparable body mass that do not hibernate (Prinzinger, 2005). It should be noted, however, that this relation does not always hold. Marsupials with a lower metabolic rate, for instance, have a shorter life span than body mass-matched other mammals (de Magalhaes and Toussaint, 2002). Nevertheless, the generality of the relation between body mass and physiological life span strongly suggests that the maximum metabolic scope is indeed an important determinant of the physiological life span, but it does not provide a mechanism for how the mass-specific energy metabolism, and hence physiological life span, is limited.

Oxidative stress

Oxidative stress is thought to be the main factor contributing to aging (Clark, 2004; Heininger, 2002; Nohl et al., 1997; Troen, 2003). During the generation of adenosine triphosphate (ATP), the mitochondria inevitably form some oxygen free radicals, oxygen molecules with an unpaired, highly reactive electron. These oxygen radicals may affect proteins and DNA, resulting in an impaired cell function and ultimately death. There are also other sources of oxygen radicals, and exercise is associated with a burst in oxidative stress not derived from mitochondria. If oxygen radicals indeed play an important role in aging, then a reduction of their generation should result in an increased life span. Indeed, a significant increase in life span of houseflies reared at lower temperatures, or with reduced activity levels, was related to a lower metabolic rate and diminished formation of reactive oxygen species (Heininger, 2002; Troen, 2003). Finally, the increase in life expectancy of many animals subjected to caloric restriction is associated with a decline in oxidant production and oxidative damage, lending further support to the importance of radicals in the aging process (Dirks and

Leeuwenburgh, 2006; Heininger, 2002). It should be noted that these observations are also in line with the theory of maximum metabolic scope, and it may well be that the formation of reactive oxygen species is the mechanism of the theory discussed above.

Interestingly, UV-induced DNA damage in paramecium resulted in a decreased life span of a clone; the clone ceased to exist earlier than when not exposed to UV-light. If, however, DNA repair was induced by exposure to visible light, photoreactivation, no decrease in clonal life span occurred. Moreover, an increased clonal life span occurred after repetitive UV exposure and photoreactivation, possibly by enhancing DNA repair (Smith-Sonneborn, 1979). The DNA-repair enzyme involved in the photoreactivation is photolyase, which is activated by visible light.

There is no evidence, however, of increased protein miss-synthesis during aging, which corresponds with the absence of a change in the overall DNA repair capacity (Troen, 2003). This might appear at odds with the above statement that reactive oxygen species may cause damage of DNA molecules. It should be noted, however, that in particular, mitochondrial DNA (mtDNA) is vulnerable to oxidative damage, as the mtDNA repair system is less effective than that for nuclear DNA. More importantly, the mtDNA is much closer to the source of the oxygen free radicals than is the nuclear DNA (Heininger, 2002).

The formation of reactive oxygen species may even be aggravated during aging by a kind of positive feedback loop, where the free radicals cause not only mutations in the mtDNA but also oxidative modification of antioxidant and DNA repair enzymes resulting in defective mitochondria. This in turn produces even more reactive oxygen species and an impairment of oxidative damage repair (Heininger, 2002). Over time this oxidative stress may result in an elevated intracellular Ca^{2+} concentration that disrupts the cytoskeleton (Heininger, 2002) and results in an accumulation of inappropriately functioning proteins (Heininger, 2002; Troen, 2003). In this context it is interesting to note that extrapolating the curve of age versus occurrence of mitochondrial DNA deletions in the human heart yields an age of 129 years at which point 100% of the mitochondrial DNA will have deletions (Troen, 2003). Coincidentally, the decline in muscle power and strength during aging also converges to 0 at around 120 years (Degens, 2008). This is close to the maximal life span, if we can apply that text as such, mentioned in Genesis 6:3: “His days will be an hundred and twenty years” (KJV).

Remodeling of DNA

It has been shown in cell culture that cells can undergo a limited number of cell divisions (usually around 50), which is, albeit weakly, inversely related to the age of the donor (Macieira-Coelho, 1993; Troen, 2003). In the human body, old cells are continuously replaced by new cells. In order to do so, progenitor cells divide into two daughter cells such that each daughter cell receives an equal share of DNA. It appears, however, that the DNA is not always distributed evenly to the daughter cells, which could be due, for example, to errors in DNA synthesis (Macieira-Coelho, 1993). This is true particularly with genes coding for proteins in the cytoskeleton.

The cytoskeleton is not only important for maintaining the shape of the cell, but components of the cytoskeleton also play a role in mechano- and signal-transduction, cell division, cell-cell interaction, and gene expression. Clearly, a disturbance in the cytoskeleton may cause a disturbed cell, and even whole body function. One example is Duchenne muscular dystrophy where a mutation in the cytoskeletal protein dystrophin causes disturbed skeletal muscle function resulting in premature death. The unequal distribution of the DNA to the daughter cells may progressively hinder initiation of proliferation (Macieira-Coelho, 1993; Troen, 2003) and thereby provide a possible timer that indicates the age of the cell and hence the organism. Ultimately, the progressive impairment of the initiation of cell division may be such that no further cell divisions are possible.

More recently, there has been an interest in the role of telomeres in the aging process. Telomeres are stretches of DNA at the ends of chromosomes that play an important role in making replication of the DNA possible. The telomere shortens with each cell division, and this may limit the number of divisions a cell can complete. Indeed, elongation of telomeres increases the number of divisions a cell can accomplish, while shortening the telomere diminishes the replicative capacity of the cell. Based on these observations it has been suggested that telomere length may be the cellular “aging clock” (Heininger, 2002; Troen, 2003). The enzyme that accomplishes the lengthening of the telomeres is telomerase, and the activity of this enzyme contributes to the immortality of the germ line. Also the immortality of the HeLa cell line, often used in laboratories, is related to an overexpression of telomerase, preventing the shortening of the telomeres after DNA replication.

Biological clock

As stated above, the number of divisions per cell is limited. In the whole body, however, some cells undergo a much higher rate of replication than other cell types. Theoretically a situation may develop in which the cells that have replicated often cannot replicate further while cells that have been replicating much less have many more replications “available” and are still in the “power of their youth.” In other words, there might be an intra-individual variation of the rate of aging (Heininger, 2002). One may wonder whether and, if so, how the aging process is coordinated in a multicellular organism with different cell types.

It has been proposed that there might be a central timing device that coordinates the aging process of the individual cells in an organism. One such clock or timing device suggested is the pineal gland (Kloeden et al., 1993). This gland produces melatonin, which influences the rhythm of many metabolic processes (Hadorn and Wehner, 1977). During aging the nightly melatonin peak decreases, which may somehow inform all cells about the age of the organism (Kloeden et al., 1993). In support of this theory is the observation that the life span of old mice increased when implanted with a pineal gland from a young mouse. A similar result was obtained when extra melatonin was added to the drinking water during the night (Kloeden et al., 1993). Such suggestions, however, are at best speculative and deserve further study, not in the least to explore the mechanism by which the decline in the nightly melatonin peak may inform cells of the age of the organism.

Longevity genes

Several genes have been associated with longevity, and many of those appear to affect the metabolic rate or the resistance to oxidative stress (Clark, 2004; Kirkwood, 2002; Troen, 2003). Also, mutations in DNA repair genes may impact the life span of an organism (Heininger, 2002; Troen, 2003). One particular example of the effects of a mutation in DNA repair genes is Werner's syndrome, characterized by a form of accelerated aging and early death (Troen, 2003). Extension of the life span in the laboratory resulting from a mutation in a certain gene may come at the cost of fitness and thus be far from beneficial in natural conditions (Walker et al., 2000). Although there seems to be a genetic component of aging, "longevity genes" do not abolish aging; they merely delay the aging process by improving the repair capacity, antioxidative capacity, and survival of the cells (Heininger, 2002; Kirkwood, 2002).

Evolution of Senescence and Death

In the previous section of this paper it was indicated that oxidative stress may be one of the most important causes of aging and ultimately death. Therefore one could ask, "Is the generation of reactive oxygen species a mistake of evolution or the Creator?" This cannot be the case because reactive oxygen species play important roles in cell signaling, function, and cell differentiation (Barja, 1993). To repair the damage caused by reactive oxygen species, the cell contains numerous antioxidant enzymes, a system that continuously checks for mutations making use of the redundancy of the genetic code, and more than 150 DNA repair genes (Bergman, 2006; Wood et al., 2005). The repair machinery is so elaborate that Kirkwood (2002) stated that organisms are "programmed for survival, not death." The continuous repair, however, requires many resources, especially when exposure to a hazardous environment or generation of reactive oxygen species increases in severity. Therefore, it is argued that aging and death are the consequence of the trade-off between the cost of continuous repair and the chance of accidental death on the one hand and the cost of reproduction on the other (Heininger, 2002).

Assuming that, in principle, an organism is immortal, accidental death will cause the proportion of individuals of a certain generation to decrease over time, and death of all is ultimately inevitable (Figure 1). Investment of all resources into damage repair to enhance survival thus may be futile, particularly when one realizes that it occurs at the expense of investment of resources in growth and reproduction (Kirkwood, 2002). Indeed,

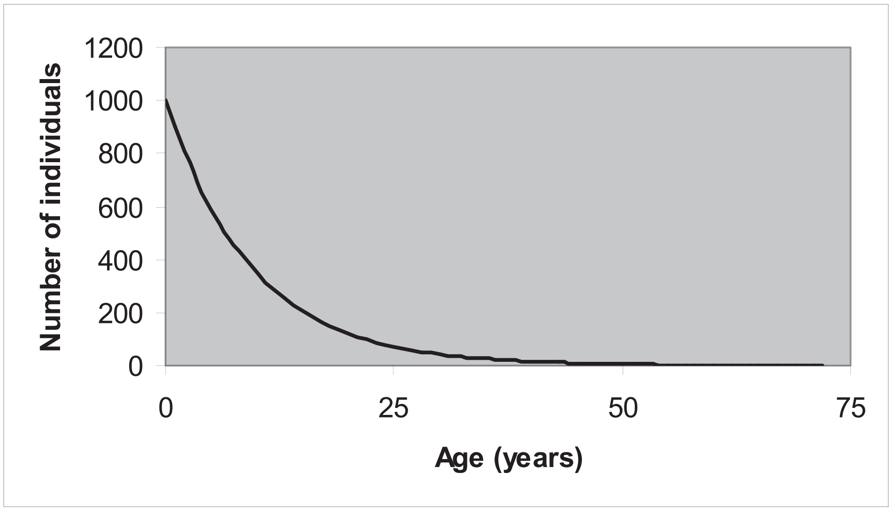

Figure 1. In analogy of the test tube example of Medawar (Medawar, 1952), let us assume that at time 0 years 1000 physiologically immortal individuals were born. They are exposed to extrinsic factors that cause an annual 10% risk of death. It can be seen that despite an unlimited physiological life span, the external factors cause practically all individuals to have died by the age of 55; the ecological life span is 55 years. It can be understood that in a less-than-perfect world it is a waste of energy and resources to spend everything on immortality. It would be better to divide the resources between reproduction and survival. This also has been called the germ-soma conflict for resources (Heininger, 2002).

the rate of aging may well be related to the severity of exposure to hazardous environmental factors, as with increasing hazards the cost for maintenance and repair may become so excessive that reproduction becomes impossible when seeking to maintain survival.

Because of this, von Weizsäcker (1980) suggested that death is an inevitable element in evolution. Individuality (an organism as self-maintaining system) and death are, according to him, inseparable "inventions of nature." Accordingly, somewhere during evolution, aging and death must have come into existence. That death does not need to exist can be seen in single-cell organisms, which essentially have an unlimited life span; they propagate by cell division resulting in two virtually identical daughter cells. It is suggested that only when multicellular organisms, which have both germ cells (eggs and sperms) and somatic cells (such as muscle and nerve cells, etc.), appeared on the stage did aging and death come into existence.

The somatic cells would be specialized to create the optimal conditions for the germ cells. The whole purpose of this division of tasks between the germ line and somatic line was to increase the reproductive success of the species (Cremer, 1980). One thus could say that the soma became disposable and this theory has aptly been called "the disposable soma theory." It is suggested that aging and death resulted from a period of shortage of food, somehow causing the differentiation of a germ line that could survive by extracting nutrients from the dying somatic cells (Heininger, 2002).

But why would evolution favor the germ cell line and not the somatic cells, giving them immortality instead (Cremer, 1980)? Or, formulated differently, why are organisms not immortal (von Weizsacker, 1980) or able to function adequately at old age (Partridge and Barton, 1993)? Could immortal somatic cells not in the same way obtain nutrition from dying germ cells, without the need for differentiation as happens in single-cell organisms? This latter question is not too far-fetched, as there is evidence that immortality of the soma does exist in nature, though not at the expense of the germ line, as for instance in Hydra (Martinez, 1998), the hydrozoa *Turritopsis nutricola* (Gilbert, 2006), the bristle cone tree, and many fungi. Yet, most organisms do indeed suffer from senescence and ultimately death. Thus, the question remains regarding how this differentiation in germ and somatic cell lines occurred in the first place.

Although there is no unequivocal evolutionary explanation for the origin of senescence and death, the observation that most multicellular organisms eventually die suggests that true immortality is impossible (Cremer, 1980). One has to realize that most evolutionary theories about senescence and death do not so much explain their origin, but rather deal with the prediction of life history traits. The two most important current theories on senescence and death or, better, the determination of the optimal life history are:

1. Negative pleiotropy, which states that senescence is due to genes that have a twofold effect: positive at early age and negative at later age.
2. Senescence is the consequence of mutation accumulation (Hughes et al., 2002; Partridge and Barton, 1993).

Assuming that in principle an organism is immortal, accidental death will inevitably cause the proportion of individuals of a certain generation in a population to decrease over time (Figure 1). The theory of antagonistic pleiotropy specifies the optimal life history possible within physiological and ecological constraints. According to this theory, senescence is the cause of genes that have a beneficial effect at young age and a detrimental effect at old age. Because of the decrease in the number of individuals of a certain generation over time, the force of natural selection decreases with age. It is thus possible that some genes that have an advantageous effect at young age and a detrimental effect at old age, being genes that are negative pleiotropic in old age, may be selected (Medawar, 1952; Troen, 2003).

One example of such a gene is p53. It has been shown that overexpression of the p53 gene (producing an abundance of the protein) inhibits the progression of cancer, but at the same time accelerates aging (Troen, 2003). The attenuation of the development of tumors is clearly beneficial early in life, but the acceleration of aging is not advantageous later in life. Genes such as the p53 gene, however, are present in all life-forms and it is thus unlikely that they have evolved. It has, for this and other reasons, been suggested that "the notion of antagonistic pleiotropy be dropped from theories of the evolution of senescence" (Clark, 2004).

The theory of mutation accumulation states that ultimately senescence and death are due to the accumulation of mutations. It is argued that as the influence of natural selection decreases with age, the abundance of mutants that have a detrimental effect at old age will become more abundant in the population (Hughes et al., 2002; Partridge and Barton, 1993; Service, 1993; Stearns and Hoekstra, 2000). Such an accumulation of mutations that have a detrimental effect at old age will eventually cause death. Therefore, after a certain age it might be better, in evolutionary terms, to invest resources in reproduction rather than survival. As a result, over time an optimal life history will eventually emerge. This optimal life history will be an evolutionarily stable strategy (given the circumstances no other life history will result in a better reproductive success) (Partridge and Barton, 1993). If selection occurs for improved fitness at old age, senescence and death will be delayed. This is observed in fruit flies artificially selected for a high fitness at old age (Service, 1993; Stearns and Hoekstra, 2000).

Von Weizsäcker (1980) suggested that organisms with a short life history will have a higher rate of evolution than those with a long life history. This, he argued, is because organisms with a short life history, or generation time, can "try out" more mutants in a given time than those with a long life history. Furthermore, the old and new generation would need to share resources like food and habitat. Seen in that light, it is better that the old generation quickly disappears to make place for the new generation. The population with the shorter life history, a shorter life span, and more offspring thus may produce more variety than the longer living population and would have an evolutionary advantage.

It is clear, however, that there is quite a large range in the life expectancy of organisms, and there also is a need to explain the existence of relatively long life histories and life spans. One suggestion is that a longer life history and life span could have been brought about by an increase in the brain to body mass ratio during evolution, which was accompanied by a lower selection pressure by predation (Sacher, 1980). With the possible exception of primates, the increase in brain mass also led to an increase in the ability to control the environment. This is something that has to be learned and consequently, it is argued, the pressure for early sexual maturity decreased, and henceforth sexual maturity occurred at a later age (Hart and Stephens, 1980). If the training and care are to be provided to a large extent by the parents, then the life span may also increase even after the reproductive period. The latter, interestingly, also implies the possession of altruistic genes.

Senescence and Death in the Creation Model

In the creation model we would expect that all organisms would originally be immortal and thus be provided with extensive machinery for repair and maintenance. This indeed is the case, as there are at present already at least 150 known DNA repair proteins (Bergman, 2006; Wood et al., 2005). Moreover, there is a fourfold redundancy of the genetic code in diploid organisms (each DNA molecule consists of two strands, two DNA molecules form a chromatide) protecting the cell, and hence the organism, from the detrimental effects of a deleterious mutation in one of the DNA strands.

Finally, multicellular organisms have a mechanism to eliminate damaged cells via programmed cell death, or apoptosis, further protecting the organism from unwanted cell proliferation, as in cancer, and ultimately malfunctioning organs and death (Bergman, 2008). However, after the Fall conditions deteriorated as predation occurred. If we assume that there was some sort of protective vapor canopy around the earth before the Flood, pre-Flood organisms would have been protected more from hazardous radiation from space than contemporary organisms. This might explain the longer life expectancy before the Flood. Further, it might well be that the maintenance and repair machinery in our cells is not adequate to fully reverse damage caused by the present-day environment but is well suited for the conditions before the Flood. Moreover, following the test-tube example by Medawar (1952), it becomes clear that with the exposure to external lethal factors it pays to invest in reproduction rather than longevity. Hence, senescence occurred after the Fall and occurred even earlier in life after the Flood.

Conclusion

Several mechanisms of senescence have been discussed, but ultimately they boil down to the accumulation of damage to proteins and DNA, particularly mitochondrial DNA. In this context, it is interesting to note that extrapolation of the rate of mitochondrial DNA mutations yields an age of 129 years where all mitochondrial DNA will have deletions. This is close to the 120 years mentioned in Genesis 6:3. The evolutionary origin of senescence is thought to have occurred during the differentiation of a germ and somatic line (Heininger, 2002; von Weizsacker, 1980).

Although it is clear that somatic cells die while germ and cancer cells are in principle immortal, the evolutionary-based theories for the origin of senescence and death provide no satisfactory answers and are highly speculative. Most evolutionary theories of senescence and death really do not deal with the origin of senescence and death, but rather with optimal life history. They prove to be quite powerful in explaining the life histories observed in natural populations and have also proved adequate to predict changes in life history when populations of laboratory animals were manipulated. If the pressure on a population of extrinsic lethal factors, such as predation, decreases, the life span of the individuals in the population increases. This is explained by the fact that the contribution of older organisms to the total reproductive success of the population increased and it thus became more profitable to invest in maintenance and repair at the expense of fertility at a young age (Stearns and Hoekstra, 2000).

If we extrapolate this observation, it is tempting to speculate that in the presence of limiting damaging factors and a complete absence of mortality related to external factors, investment in repair and maintenance becomes so profitable that the maintenance and repair mechanisms of the cells are improved to such an extent that ultimately even immortality may be possible. This suggestion is not completely without justification as is indicated by the immortality of the germ cell line, the continued existence of single-cell organisms, and even immortality of multicellular organisms

(Gilbert, 2006; Martinez, 1998). Stated differently, mortality could be the consequence of deteriorated circumstances, making immortality practically impossible because of extrinsic lethal factors. This suggestion then would fit the notion that there probably was no death before the Fall (Henry, 2006).

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A Hypercane Deposit at Little Stave Creek, Clarke County, Alabama, USA

Carl R. Froede, Jr.*

Abstract

Unique atmospheric conditions during and immediately following the Flood have recently been postulated based on the results of numerical computer modeling. This modeling suggests that the heating of the atmosphere and oceans could have produced conditions suitable for the development of super hurricanes, or "hypercanes." Unfortunately, the atmosphere provides no historic record of such events. However, proxy records might be found in the rock record. In fact, it is probable that hypercanes would have created large-scale tempestites (i.e., storm deposits) across various portions of the continents while they were covered by Floodwater. Such storm deposits occur across the United States Gulf Coastal Plain. One such stratigraphic unit is the Gosport Sand Member of the Lisbon Formation (Eocene), which extends across southwestern Alabama. A Gosport Sand outcrop at Little Stave Creek in Clarke County exhibits sedimentary evidence that it formed from a single massive hypercane during the Middle Flood Event Division.

Introduction

Modern hurricanes are defined by the National Weather Service Saffir-Simpson scale (National Hurricane Center/National Weather Service, 2006). This ranking system is based on the storm's wind speed, storm surge, and the destruction of property. The size of a hurricane is dependent on the available heat energy derived from warm surface water and a warm atmosphere (Emanuel, 1988; Holland, 1997). Today, insufficient heat is available to create anything larger than a Category 5 hurricane.

But scientists have proposed larger storms in the past. Hypercanes are envisioned as large-scale hurricanes, but these super storms exist only as theoretical computer models. Uniformitarians believe that hypercanes may have formed as a result of excessive heat held in both the atmosphere and ocean derived from volcanic eruptions and extraterrestrial impacts (Emanuel et al., 1995). These massive storms would have been much larger and more powerful than any modern hurricane (Table I).

Atmospheric events such as hurricanes and hypercanes leave no climatic evidence that they ever occurred. However, their confirmation might be captured in the rock record by tempestites (i.e., storm deposits). The Gosport Sand Member of the Lisbon Formation (Eocene) extends across a portion of southwestern Alabama (Figure 1). Perhaps the best outcrop to examine the Gosport Sand occurs at Little Stave Creek in Clarke County, Alabama. This locale provides an excellent exposure of a tempestite most likely formed from a single hypercane.

Hypercanes

The concept of a super hurricane, or hypercane, was first postulated by atmospheric scientist Kerry Emanuel (1988) based on his numerical computer modeling of atmospheric heating by warm

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Table I. Comparisons between a modern Category 5 Hurricane (Saffir-Simpson scale) and a hypercane. Modified from National Hurricane Center/National Weather Service (2006).

Storm Category	Storm Characteristics	Storm Surge	Top Wind Speed Along Eyewall	Elevation of Cloud Tops*
Category 5	Winds greater than 155 mph (249 km/hr). Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3–5 hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5–10 miles (8–16 km) of the shoreline may be required.	Storm surge generally greater than 18 ft (5.5 m) above normal.	200–250 mph (322–402 km/hr)	Top of the Troposphere** (~ 4.0 to 11 miles/6.0 to 18 km)
Hypercane	Winds greater than 400 mph (644 km/hr). The massive storm would likely stir not only surface water but extend downward several hundred feet mixing marine waters and eroding/depositing sediments across the seafloor. Any vegetation seeking to establish itself along an existing coastline would be either washed away (if within the zone of storm surge) or be severely damaged by the high winds as the storm made landfall. Hypercanes would have had a dramatic effect on the morphology of any developing coastline.	Storm surge would probably be greater than 50 feet (15.2 m) but could have been twice this elevation due to the length of time and distance over the very warm Floodwater heated by subaqueous/subaerial volcanism.	500 mph (805 km/hr)	Upper Stratosphere (~ 11 to 31 miles/18 to 50 km)

* Unique Flood/post-Flood climate conditions may have resulted in different atmospheric elevational boundaries due to heating.

** Few modern hurricanes have penetrated the lower stratosphere (Monastersky, 1998), but this would have been typical of hypercanes which probably extended up into the middle to upper stratosphere (Emanuel et al., 1995)

oceanic water. This work demonstrates that a hypercane could develop from sufficiently warm seas where surface temperatures are greater than 113° F (45°C) (Emanuel et al., 1995). The resulting super storm would reach higher into the atmosphere, extend across a greater distance, and have faster sustained winds than the most powerful modern hurricane.

Hurricane Camille, a Category 5 storm, had the highest wind speed of any hurricane to date—estimated at more than 200 mph (322 km/hr) (National Weather Service, 2006). This wind speed pales in comparison to an estimated hypercane wind speed of 492 mph (792 km/hr) (Emanuel et al., 1995). Winds generated by a hypercane also would create an exceptionally large storm surge, with surface waves that would move in

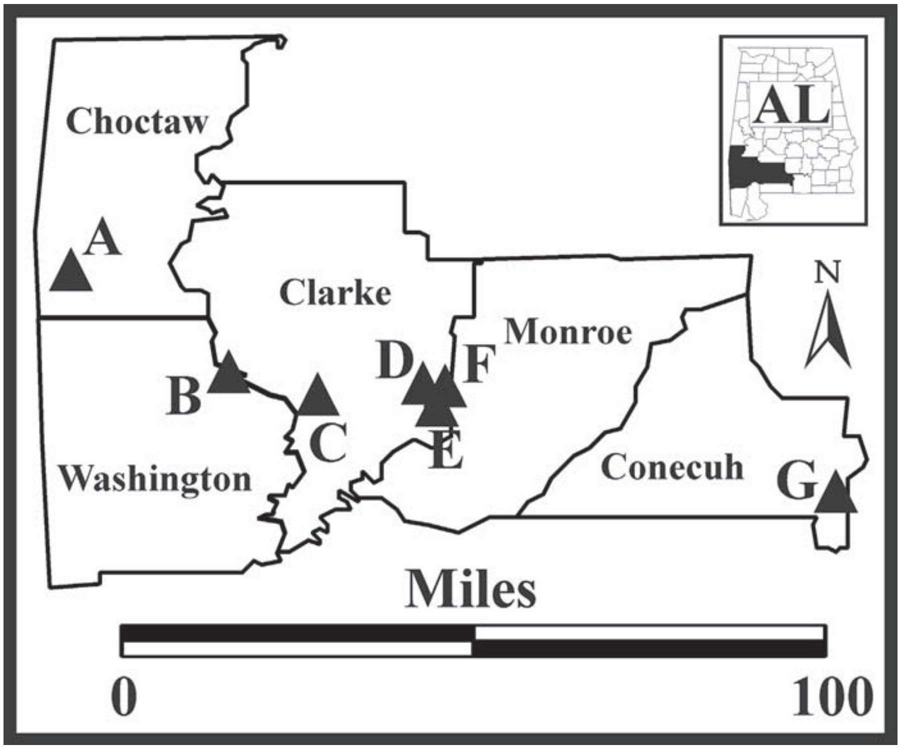

Figure 1. Base map showing the Gosport Sand Member outcrops cited in this article. The stratigraphic unit is consistent with the general strike of the coastal plain sediments in this area. See Table II.

advance of the storm, similar to those of modern hurricanes. For example, Hurricane Katrina had top wind speeds measured at 140 mph (225 km/hr), which created an open water storm surge combined with surface waves estimated at 55 ft (16.8 m) (Graumann et al., 2005). Hypercanes could have created massive storm surge/surface waves in open water at least double that of any modern hurricane. Landfall of a hypercane likely would have impacted the coast with storm surge/surface waves 50 ft (15 m) or higher. This volume of displaced water is important when considering the generation of counterflowing bottom currents across the inner shelf setting as the storm moved landward.

Young-earth creationists also have investigated the possibility of hypercanes. Woodmorappe (1998; 2000) invoked them to generate the 40 days of rain at the onset of the Flood, while Vardiman (2001; 2003) proposed that they occurred during and following the Flood. A combination of global volcanism and extraterrestrial bombardment during the Flood could have provided the necessary heat to form hypercanes (Froede, 2007).

Modern hurricanes generally occur within the troposphere (Figure 2), although occasionally they can penetrate the tropopause and cross over into the lower stratosphere (Monastersky, 1998). Computer modeling by Emanuel et al. (1995) suggests that with sufficient heat derived from both the atmosphere and oceans, hypercanes would have extended upward to the middle/upper stratosphere (see appendix). At this extreme elevation, water droplets carried upward by a hypercane would be converted to snow and ice crystals that could drift in this portion of the atmosphere for years (Emanuel et al., 1995).

Atmospheric Stirring of Oceanic Water

Large storm-generated surface waves can mix horizontally stratified oceanic water layers across the continental shelf (e.g., Halper and Schroeder, 1990; Powell, 1982; Shay and Elsberry, 1987). With sufficient near-bottom orbital velocities, they can even stir the seabed. This can result in considerable displacement of seafloor sediment and associated fauna. Storm wave energy would greatly disturb sea life living within those sediments. Bottom currents would effectively erode and transport sediments and any organic materials seaward (Figure 3). For example, moving across open water in the Gulf of Mexico, Hurricane Ivan had top wind speeds estimated at approximately 165 mph (266 km/hr) (Category 5 hurricane). The Naval Research Laboratory measured Hurricane Ivan's peak storm surge and wave height on the outer continental shelf using submerged acoustic Doppler current profilers. These devices measured wave elevations as high as 92 ft (28 m) near the areas of maximum wind stress (Wang et al., 2005). These large waves had sufficient near-bottom orbital velocities to stir approximately 130 million cubic yards (100 million cubic meters) of seafloor sediment along the 22 by 9 mile (35 by 15 km) path of the hurricane (Teague et al., 2006). Bottom currents operating within this area scoured seabed sediments in places up to 14 inches (36 cm) deep in water as deep as 197 ft (60 m) (Teague et al., 2006). With this much impact to the seafloor from a Category 5 hurricane, it is not difficult to imagine the tremendous seafloor erosion and deposition that would have occurred on the continental shelf due to a passing hypercane.

Little Stave Creek, Alabama

Little Stave Creek is located in Clarke County, Alabama (Figure 1). The creek flows toward the west-southwest into Stave Creek, which eventually discharg-

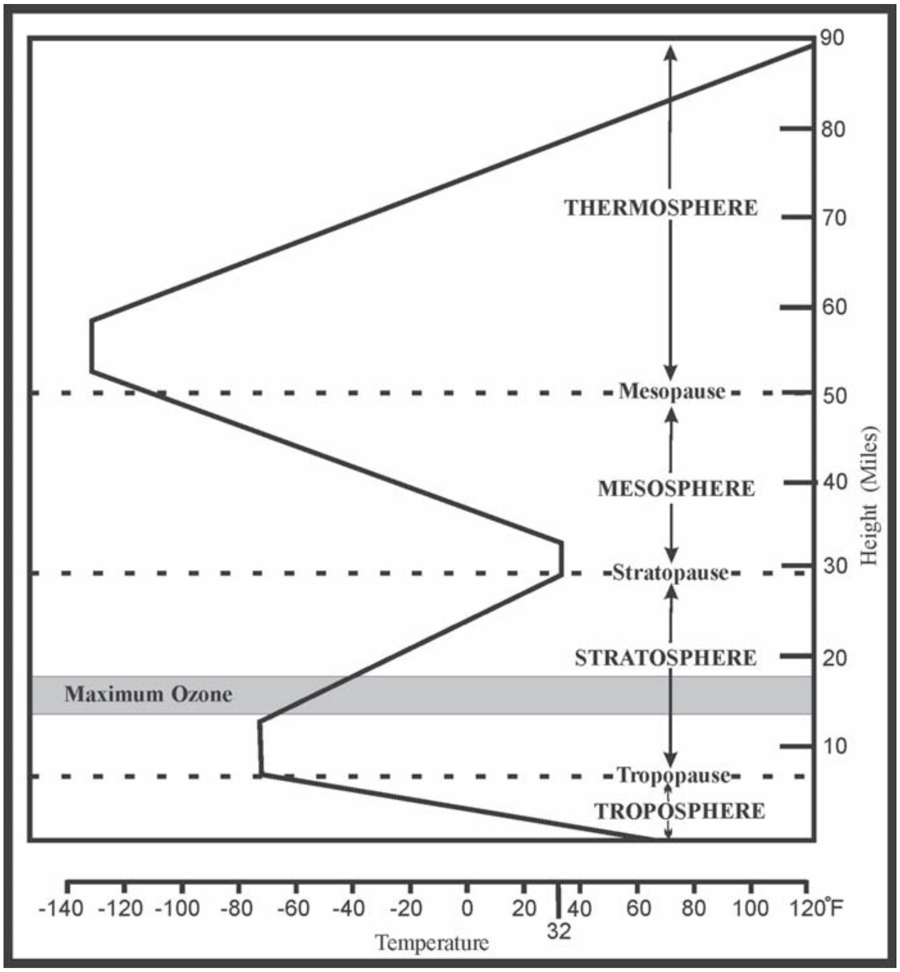

Figure 2. The layering and thermal structure of the modern atmosphere. The elevation of the tropopause increases, moving from the poles toward the equator. Our weather occurs within the troposphere, but atmospheric scientists suggest that hypercanes could have extended into the middle/upper stratosphere. This is not inconsistent with the biblical framework of Earth history. Adapted from Lutgens and Tarbuck (2004, Figure 1–22).

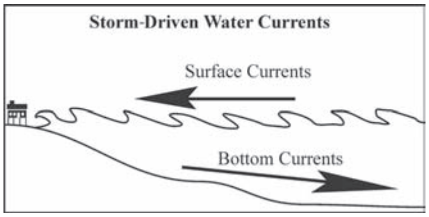

Figure 3. Incoming storm surge and surface waves can create a counter-flowing bottom current of sufficient velocity to scour seafloor sediments, transporting and burying them some distance from their original location. The resulting deposit of shells and matrix would not represent the original environment from which it was derived.

es into the Tombigbee River. The exposure of the unique stratigraphic section along Little Stave Creek is a direct result of underlying salt tectonics. Uplift and faulting of the area has created surface exposures of strata that normally would be found several hundred feet below the ground surface. Alabama state geologist Michael Tuomey in 1850 (Toulmin, 1962) first recognized these unique conditions. Hopkins's (1917) geologic map of the area was the first to document exposures of Claiborne and Jackson age (Eocene) strata along the creek.

Approximately 400 vertical feet (122 m) of strata are exposed in the sidewalls along Little Stave Creek over a distance of one mile (Bandy, 1949). Active study of the fossilized shells began in the 1930s and resulted in a publication describing some of the preserved pelecypod shells (Gardner, 1939). In 1940, Toulmin published the first stratigraphic section exposed along the creek (Toulmin, 1940). In the years that have followed, Little Stave Creek has become an internationally known site of paleontological interest. The stratigraphic layers extend from the uniformitarian lower Eocene upward to the lower Oligocene Epochs. Many of the stratigraphic units contain key index fossils allowing further subdivision into discrete time intervals (see Bandy, 1949; Gardner, 1957; Mancini and Tew, 1988; 1990; Toulmin, 1962; 1977).

Paleoecological Setting

Many investigators have noted the unique conditions of the stratigraphic section exposed along Little Stave Creek. Bandy's (1949) examination of foraminifera led him to propose that the entire section was deposited in "a predominately warm, shallow sea with relatively little turbidity" (p. 38). Gardner (1957) suggested a more turbid setting:

> The entire sequence of Eocene and Oligocene sediments was probably laid down on a shifting continental shelf beyond the intertidal zone. The shores were low and not rocky. None of the load brought down by the streams was very coarse; the desirable habitat of most of the Mollusca, at least of most of the pelecypods, was just beneath the surface of the

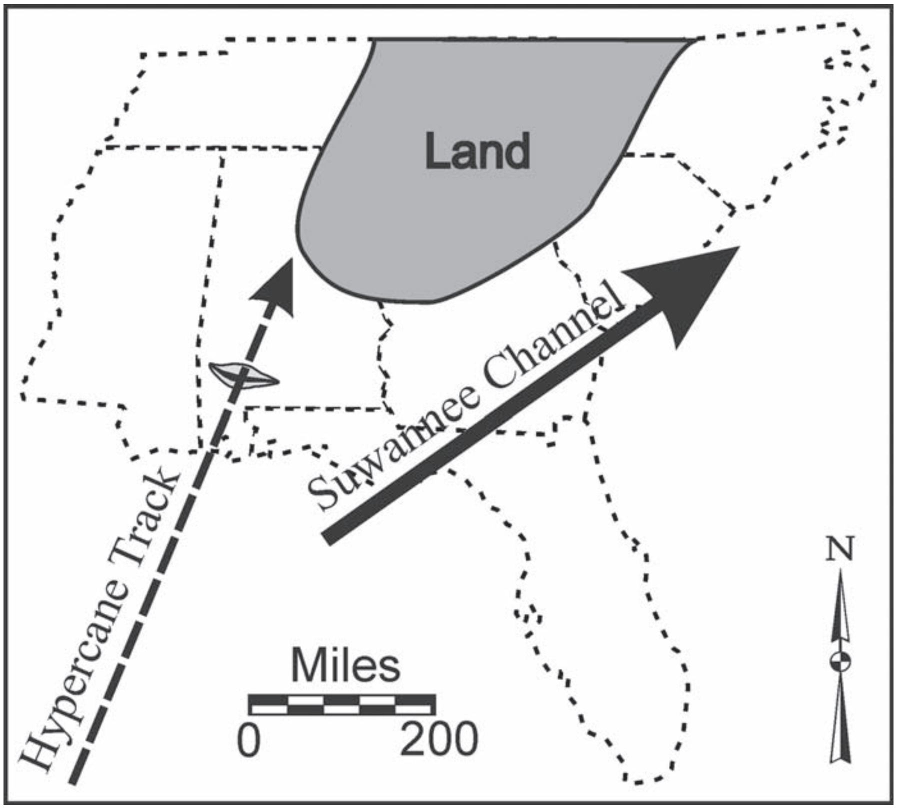

Figure 4. Proposed scenario for the deposition of the Gosport Sand Member across southwestern Alabama. Large arrow shows the position and flow direction of the Suwannee Channel. The Gosport Sand outcrop area is black; the source area for the sediments and fossils is gray. The hypercane track is approximated by the dashed line—likely originating to the south-southwest in volcanic/meteoric heated seawater.

> sea floor; few of the sands were pure, and the mixture of silt and clay rendered the bottom easier to penetrate. (p. 586)

Estimating the water depth during the deposition of the Little Stave Creek stratigraphic section is based on the fossilized macro- and micro-invertebrate remains. Gardner (1957) proposed an average depth of about 240 ft (73 m) or less. This depth corresponds with other invertebrate fauna (e.g., Wrenn, 1996). However, Sparks's (1967) examination of both planktonic and benthonic foraminifera at the Eocene-Oligocene boundary suggests even deeper water depths, ranging between 295 and 656 ft (90 to 200 m).

Changing Sea-Level Position

Sea-level variation estimated from both lithology and paleontology also has influenced approximations of water depth. An examination of foraminifera collected from different stratigraphic units along Little Stave Creek led several investigators to conclude that sea-level changes are best defined by the diversity of planktonic foraminifera rather than by their sheer abundance (Landow-Smith et al., 1994).

A higher sea-level position during Gosport Sand deposition would correspond to a more open Gulf of Mexico; the Suwannee Channel would have connected the Gulf of Mexico and the Atlantic Ocean (Figure 4). Geoscientists believe that marine water movement during this time was from the Gulf to the Atlantic across the submerged coastal plains of Georgia and South Carolina, exiting near Charleston, SC. However, in his examination of the Eocene echinoid *Echinocyamus* found along the Carolina Coastal Plain, Zachos (2005) proposed that the flow of the Suwannee Channel reversed direction during Gosport deposition in order to explain the sudden appearance of *Echinocyamus* along the Gulf Coastal Plain.

Possible Water Temperatures

Gardner (1957) believed that the variety of invertebrate fossils found along Little Stave Creek indicated water temperatures as high as, if not higher than, today's northern Gulf of Mexico. Based on palynomorph (i.e., spore and pollen) fossils collected from Eocene strata across the southeastern United States, Frederiksen (1988) envisioned a coastal latitude analogous to the modern Florida Keys. However, Wolfe (1985) believed the water was even warmer and proposed that water temperatures were closer to those of northern South America, based on his examination of plant fossils.

Allochthonous versus Autochthonous Fossil Faunas

Gardner (1957) noted that most of the fossil faunas exposed along the creek section were allochthonous:

> Probably very few of the fossil faunas represent biocoenoses or natural assemblages of living faunas; rather they are assemblages of shells that were swept along the bottom and mingled with other faunas from other feeding grounds. A large percentage of the community has probably been lost. (p. 573)

The extraction, transport, and burial of the shells would fail to fully represent all of the marine life that likely coexisted in the original communities. The loss of invertebrate community information could also occur with the dissolution of shell material from the rock record (Lawrence, 1968; Stephens et al., 1973).

From the micro-paleontological perspective, an examination of calcareous nannofossil assemblages from within the tests of *Hantkenina* foraminifers collected from the Shubuta Formation (Eocene) and Bumpnose Formation (Oligocene) also supports the reworking of the original deposits (Bybell and Poore, 1983). This reworking could have occurred from intensive bioturbation or mechanically by passing storms.

Sequence Stratigraphy

In the early to middle 1980s, sequence stratigraphers set out to reinterpret the eustatic history of the Late Cretaceous-Tertiary geologic section across the United States Gulf Coastal Plain. This group focused on classic outcrops and type sections (e.g., Baum and Vail, 1988; Loutit et al., 1988; Vail et al., 1987). Little Stave Creek was no exception. Loutit et al. (1983) examined various stratigraphic units spanning the Eocene-Oligocene boundary at Little Stave Creek and determined that the combination of lithologic and paleontologic information reflected a rising and falling of sea-level position across this boundary. In the following years, some Alabama state geologists also have sought to apply the concepts and principles of sequence stratigraphy to the southwestern portion of the state, including the strata exposed along Little Stave Creek (Mancini and Tew, 1988; 1990).

The most pronounced and obvious unconformity boundary found at Little Stave Creek occurs at the contact between the Lisbon Formation and the overlying Gosport Sand (Figure 5). This boundary is identified as a disconformity as it is viewed as an erosional contact between the two formations. Gardner (1957) identified this break between the clay of the Lisbon Formation and overlying Gosport Sand Member as the most striking stratigraphic feature in the entire Eocene section exposed along Little Stave Creek.

Shell Beds in the Rock Record

Sedimentary layers containing high concentrations of invertebrate shells are not unique or unusual in the rock record. Three different ideas have been suggested to account for their formation: (1) shells accumulate in areas of extremely low deposition (e.g., hiatus or condensed section), (2) they are concentrated within the shallow subsurface by the bioturbation of the sediments, and (3) they are created by storm processes.

We will focus on shell bed formation by storm events, since the shell layers found along Little Stave Creek have been interpreted as a series of storm deposits. Early work in both the field and laboratory revealed that shells can be buried by the scouring effect that the surface shape creates on the surrounding sediments (Johnson, 1957; Menard and Boucot, 1951). However, this does not explain how shells might become concentrated into a fossiliferous layer. Further experimentation revealed that the resuspension of sediments during a passing storm might excavate material, concentrate the shell lag by hydrodynamic suspension and settling, and bury the invertebrate materials (Powers and Kinsman, 1953). This process could account for the accumulation of shells in a single buried layer, but it would be limited to the depth of scoured sediment—no more than 1 to 2 ft (0.3–0.6 m).

Shell beds also may form from bottom currents that transport shell material and sediments into low-lying areas farther out on the continental shelf. The movement of water along the seafloor by bottom currents would follow the geomorphology of the seabed. Morton (1981) stated that bottom current velocity could exceed 6.6 ft/sec (2.0 m/sec) in

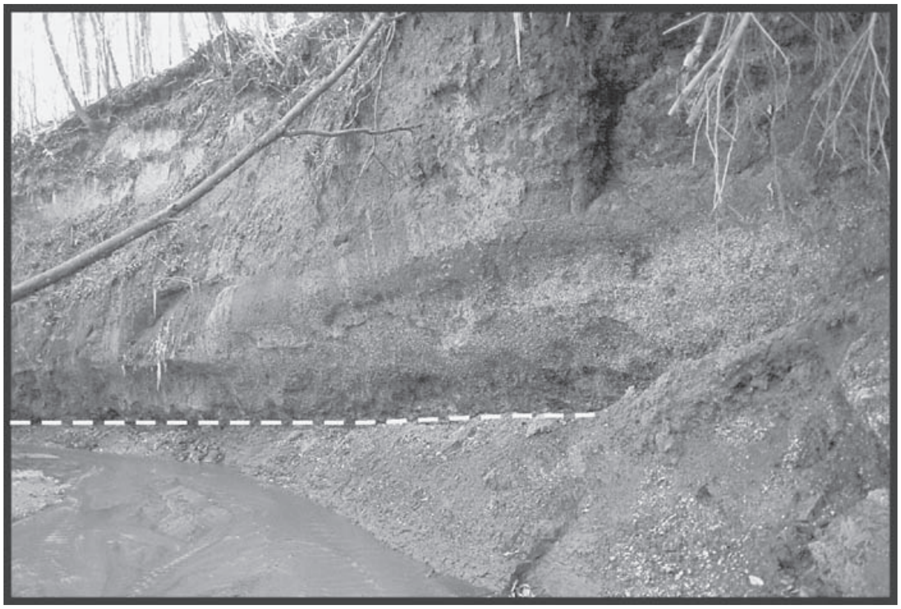

Figure 5. The contact between the top of the Lisbon Formation and base of the Gosport Sand Member occurs along the dashed line. Immediately above the contact are very coarse-grained sands that have been removed in an effort to collect sharks teeth. This has resulted in cliff face instability and has created a dangerous setting. As a result, the property owners no longer allow the public access to the property. The exposure is approximately 20 ft high.

association with larger-scale hurricanes like Hurricane Camille (a Category 5 hurricane). He further proposed that this velocity would be sufficient to move water analogous to large-scale rip currents or coastal jets. These velocities would be sufficient to scour depressions and channels along the seafloor.

What would the resulting tempestite look like? According to Morton (1981), the storm deposit would have a lobate form that would thin in alongshore and offshore directions, and the storm bed would be thickest in the vicinity of maximum storm influence. This morphology describes the Gosport Sand Member exposed across southwestern Alabama.

The Gosport Sand Member

In examining the various stratigraphic sections exposed along the Alabama River, Smith (1907) was the first person to identify and describe the Gosport Sand section from an outcrop at Gosport Landing. At this locale, the unit is a 30 ft (9.1 m) section of calcareous, medium- to coarse-grained, abundantly fossiliferous sand (Swann and Kelley, 1985). Palmer and Brann (1965–1966) identified 483 species of mollusks from this unit. Tables listing specific species collected have also been compiled in Lindveit and Lindveit (1977).

Despite its relative thickness at various outcrops, the Gosport Sand as a specific lithologic/paleontologic unit is very limited in its lateral extent (Osborne et al., 1989). Moving westward toward Mississippi, the unit changes in composition to a non-marine, cross-bedded sand and carbonaceous clay, identified as the Cockfield Formation. Moving eastward across Alabama, the Gosport Sand transitions into a yellow to orange highly cross-bedded glauconitic sand and brown carbonaceous shale (Toulmin, 1967). This stratigraphic unit thins laterally moving both east and west along strike (Table II).

Table II. Selected outcrops of the Gosport Sand Member across southwestern Alabama.

Site	County	Location	Thickness Fossiliferous Layer	Description	References
A	Choctaw	Road cut on AL12/ U.S. 84	0.5–1.5 ft (15–46 cm)	Bed 3. Sand, clayey, black, compact, with thin stringers of loose black sand. Contains lignite flakes (pebbles) and a number of well-preserved fossils.	Toulmin et al., 1951, p. 117.
B	Washington	Tombigbee River—Baker's Hill	15–18 ft (4.6–5.5 m)	The upper part of the Gosport Sand is exposed to best advantage and contains abundant well-preserved shells of a diversified molluscan fauna.	Smith et al., 1894; Toulmin, 1977, p. 381.
C	Clarke	Little Stave Creek	15 ft (4.6 m)	See text.	Toulmin, 1977; Hazel and Pitakpaivan, 1993.
D	Clarke	Gosport Landing	30 ft (9.1 m)	Calcareous, medium-to-coarse-grained abundantly fossiliferous sands.	Swann and Kelley, 1985, p. 2.
E	Monroe	Rattlesnake Bluff	10–12 ft (3 –3.7 m)	Claiborne ferruginous, fossiliferous sands, the counterpart of those at Claiborne Bluff.	Smith et al., 1894; p. 708; Toulmin, 1977.
F	Monroe	Claiborne Landing	17 ft (5.2 m)	Glauconitic quartz sand packed with shells of pelecypods and gastropods. Rare solitary corals and bryozoans, and leaf impressions in isolated clay layers are also present.	Toulmin, 1977, p. 115.
G	Conecuh	Sepulga River	3 ft (91.4 cm)	Bed 2. Fine blue-green sand loaded with Claiborne shells (USGS Station 6737).	Adams et al., 1926, p. 273.

The Gosport Sand at Little Stave Creek

According to Rindsberg and Henderson (1987, p. 70), the Gosport Sand at Little Stave Creek "is an extraordinary fossil deposit containing more than 400 species of well-preserved mollusks in a matrix of shelly, muddy glauconitic sand." They postulate that the highly fossiliferous portion of the Gosport Sand is actually an accumulated shell lag formed over time by a succession of storm events.

Toulmin (1962) divided the Gosport Sand into three informal units, totaling approximately 11 ft (3.4 m): (1) a basal unit composed of a glauconitic, medium- to coarse-grained sand that marks the disconformity with the underlying Lisbon Formation, (2) a middle unit consisting of medium- to coarse-grained, glauconitic sand with abundant well-preserved mollusk fossils, and (3) an upper unit that contains a medium- to coarse-grained, silty, calcareous, fossiliferous sand. The basal sand unit is approximately 1.0 ft (0.3 m) thick and covers a clayey bioturbated surface along the top of the Lisbon Formation. The poorly sorted coarse-grained sand actually infills the burrows along the top of the Lisbon and contains isolated pieces of various fish fossils (sharks teeth, stingray plate, and small diameter fish vertebras) that are usually worn or broken. An occasional broken or highly abraded shell also can be found within this basal unit. Interestingly, Arata and Jackson (1965) reported finding a sirenian rib fragment within this sandy zone, and Siler (1964) also found a rib fragment in this same interval 40 miles (64 km) east in Monroe County. Gardner (1957) believed that this sand layer represented a considerable span of time as she interpreted it to be a battered beach deposit.

According to Toulmin (1962), the middle fossiliferous unit is approximately 5.0 ft (1.5-m) thick and contains an amazing assortment of mollusks with the disarticulated pelecypod shells in random orientation (Figure 6). Gardner (1957) compared this shell-rich zone to the multitude of shells exposed along the beach at Sanibel Island, Florida. Many of the mollusk shells are so well preserved as to retain their original color patterns (Kelley and Swann, 1988; Swann and Kelley, 1985). The unique preservation of the shell material led Kelley and Swann (1988) to postulate the following depositional setting and conditions:

> The depositional environment is interpreted to be a shallow nearshore marine environment. This conclusion is based on: 1) the presence of glauconite; 2) excellent condition of the fossils, suggesting little transport; 3) the lack of a clean, well-sorted sand matrix; and 4) the lack of valve orientation or sedimentary structures which would indicate a beach environment. If this interpretation is correct, then the lack of bedding could be due to bioturbation by the indigenous fauna. (p. 83)

CoBabe and Allmon (1994) conducted a paleoecologic and taphonomic assessment of the fossiliferous zone and determined that the lack of any vertical community structure combined with the high concentrations of shells prevented them from characterizing the full diversity of the invertebrates.

At its type locality at Gosport Landing, Toulmin (1977) noted carbonaceous leaf-bearing clays within the fossiliferous section, which led him to believe that the paleosetting represented a nearshore marine environment. However, there are no leaf-bearing clays present at the exposure along Little Stave Creek (Hazel and Pitakpaivan, 1993).

Toulmin (1962) identified the top of the Gosport Sand section as approximately 5.0 ft (1.5 m) thick, containing considerably fewer macro-fossiliferous materials, but what is present (i.e., foraminifers, ostracodes, and mollusks) is well preserved. Regarding this section of the Gosport Sand, Gardner (1957) stated:

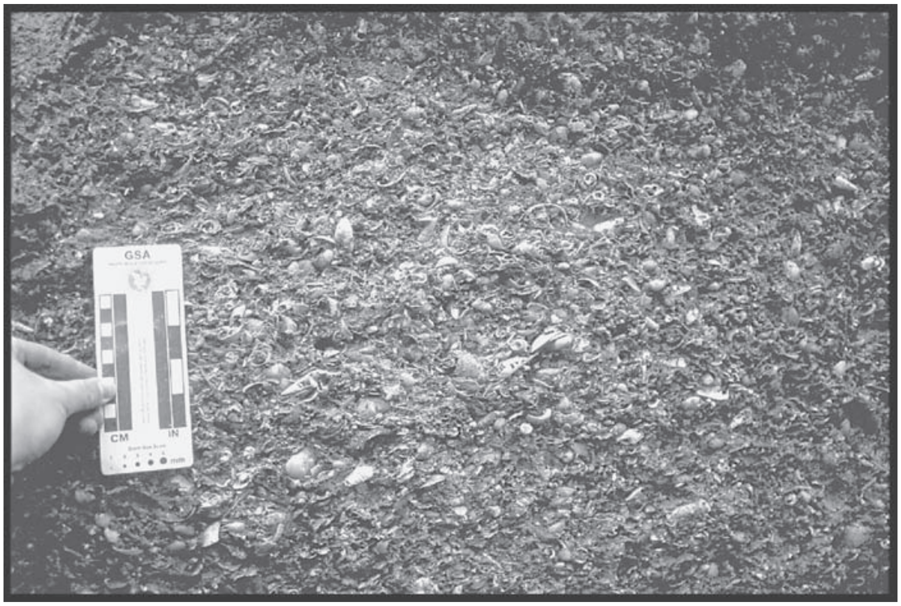

Figure 6. A high concentration of shells occurs within the middle portion of the Gosport Sand Member at Little Stave Creek. The excellent condition and preservation of the shells indicates limited transport and rapid burial. The absence of lithologic breaks within the shell layer or over- and underlying sediments suggests deposition in a single massive storm. Scale in inches and centimeters.

> The upper part of the Gosport is much more disturbed than the lower, though probably the entire Gosport sand [sic] was laid down in less than 20 fathoms (120 ft/36.6 m) of water. (p. 584)

Differentiation between the two 5 ft sections of the Gosport Sand is based on a reduction in macrofossil content (Kelley and Swann, 1988). The actual boundary location appears to be rather subjective, based on individual lithologic or paleontologic preferences.

The 11 ft of section defined by Toulmin (1955; 1962; 1966; 1968; 1977) as the Gosport Sand along Little Stave Creek is based on his own ideas regarding biostratigraphic divisions. Gardner (1957) believed that the Gosport Sand extended up 25 ft (7.6 m) from the contact with the underlying Lisbon Formation. Based on foraminifera, Bandy proposed that the Gosport Sand was 18 ft (5.5 m) thick. Using ostracodes, Hazel and Pitakpaivan, (1993) have more recently proposed moving Toulmin's (1962) contact upward into the Moodys Branch by 4 ft (1.2 m), making the section 15 ft (4.6 m) thick.

This variation in defining the boundary between the Gosport Sand and overlying Moodys Branch Formation arises from their lithological similarity (Hazel and Pitakpaivan, 1993). Some investigators who have examined the contact between the top of the Gosport Sand and base of the Moodys Branch claim that it is marked by an unconformity (e.g., Mancini and Tew, 1988; 1990; Swann and Kelley, 1985), an irregular contact (Toulmin, 1962), or a gradational sedimentary sequence so subtle as to make the boundary an arbitrary decision (Bandy, 1949; Gardner, 1957; Hazel and Pitakpaivan, 1993; Mancini and Tew, 1988; 1990; Stenzel, 1952; Toulmin, 1940). Based on my own observations at Little Stave Creek, there is no discernible erosional contact between the two stratigraphic units. While there is a rapid decrease in overall fossil content moving up into the Moodys Branch, there is no visible erosional contact (Figure 7).

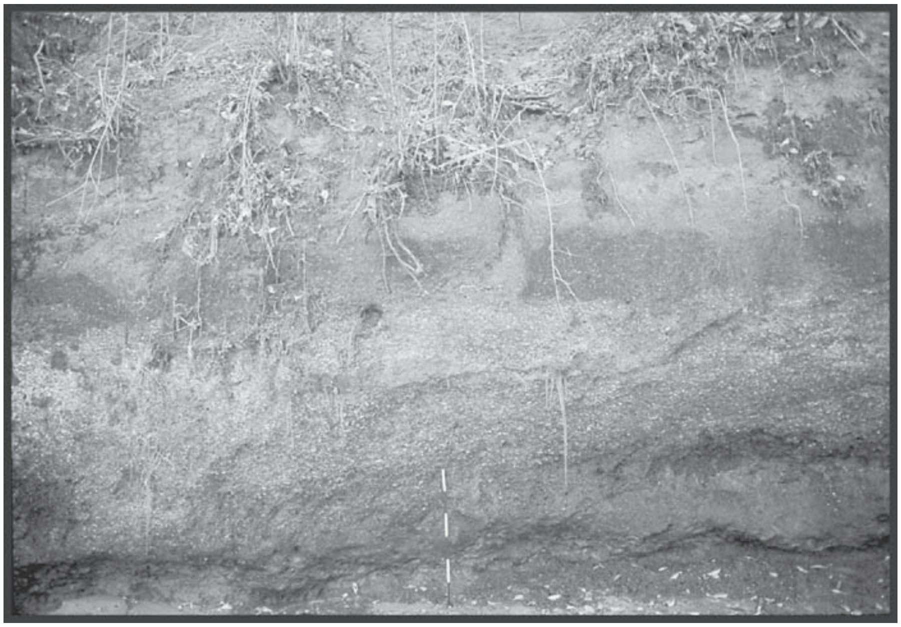

Figure 7. The Gosport Sand Member, exposed along Little Stave Creek, shows no distinct break in sedimentation. There is no indication of any post-depositional mixing of sediments or stirring of the fossiliferous layers by mechanical or organic processes. Scale in six-inch (15 cm) divisions.

The Gosport Sand Member: Is it a Tempestite?

Is the Gosport Sand Member a hypercane deposit? If so, was it created by only one storm or several? The answer can be found in an examination of the areal extent, sedimentary features, and thickness of the deposit.

Areal Extent

According to Toulmin (1977), the Gosport Sand is present from "the vicinity of the Alabama River west to the Mississippi line" (p. 115). Gardner (1957) estimates the distance as approximately 40 miles (64.4 km), from exposures along Santa Bogue Creek in Washington County to just east of the Claiborne Landing in Monroe County. However, adding the locale along the Sepulga River (see Adams et al., 1926) extends the Gosport Sand outcrop eastward along strike an additional 49 miles (79 km) and results in a fossiliferous deposit that extends across southwestern Alabama approximately 104 miles (167 km).

Sedimentary Features

The basal sand unit of the Gosport Sand appears to be a lag deposit. The abraded nature of the few shells and fish material found within the coarse-grained and highly angular sand suggests transport, and the lack of any sedimentary features indicates that it was transported along the seafloor by suspension. There is no indication of a hiatus or break in deposition anywhere in the Gosport Sand section, suggesting continuous deposition. The concentrated shell layer contains delicate shells that exhibit little to no abrasion. This is reflective of localized transport, rapid burial, and preservation. The physical evidence in support of the passage of extended periods of time over which the deposit was slowly accumulated, such as might be demonstrated by changes in sediment composition, abraded shells, and the formation of coquina layers is not present.

Thickness of the Deposit

The thickest exposure of the Gosport Sand occurs at its type locality on the Alabama River at Gosport Landing, where the unit is 30 ft (9.1 m) thick (Swann and Kelley, 1985). Approximately 4 miles (6.4 km) upriver at Claiborne Landing, Toulmin (1977) described the unit as approximately "17 feet of glauconitic quartz sand packed with shells of pelecypods and gastropods" (p. 115). Westward at Little Stave Creek, the Gosport is approximately 15 ft (4.6 m) thick. Moving farther west, Toulmin et al. (1951) reported the Gosport Sand exposed in Choctaw County, Alabama, was approximately 10 ft (3 m) thick. The easternmost exposure occurs along the Sepulga River in Conecuh County Alabama, where the Gosport Sand is approximately 3 ft (91 cm) thick (Adams et al., 1926).

Discussion

Hypercanes versus Hurricanes

It is important to remember that hypercanes exist only as numerical computer models. We have no atmospheric evidence that confirms they ever occurred. Sea surface water temperatures in excess of 113° F (45°C) are considerably higher than anything we have on Earth today. However, conditions associated with the Flood would not exclude hypercanes from consideration. The size and morphology of some of the sedimentary deposits in areas such as across the United States Gulf Coastal Plain appear to support the idea that hypercanes might have occurred in this area in Earth's past. However, these super storms would have very limited applicability within the uniformitarian framework of Earth history due to the heat necessary to form them.

Modern hurricanes can create surface waves with near-bottom orbital velocities that stir the continental shelf seabed. These forces move materials by suspension. Additionally, the shoreward movement of a large storm surge would create bottom currents with sufficient velocity to erode and swiftly transport materials (including invertebrate remains) toward deeper water out on the continental shelf. This occurs even today in association with modern hurricanes. Many of the uniformitarian investigators who have examined the strata exposed along Little Stave Creek have come to the conclusion that the sediments and fossils have been transported some distance. Gardner (1957) suggested that bottom currents were the likely cause of this mixed paleontological assemblage. For the Gosport Sand, Rindsberg and Henderson (1987) envision suspension winnowing of the sediments and shells with very little transport.

A Paleontologic Myth

Uniformitarian/evolutionary assumptions drive the interpretation of paleontological data. Purported paleoecologic settings are extrapolated from comparisons with living animals. This creates problems when a microfossil correlates to a certain setting that is not supported by the associated matrix. For example, Sparks (1967, brackets added) stated:

> It is important to remember when comparing the generic composition of recent and fossil [foraminifera] populations that some genera that live in deep water environments at the present lived in shallower environments in the past. (p. 35)

In this situation many uniformitarians would then declare the microfossil out of place or suggest that it evolved over time to adapt to a deeper water setting. However, the Flood provides a better answer. The biblical record states that wind moved across the Floodwater following the initial 40 days and nights of rainfall. These winds would have contributed to the transport of open water foraminifera across shallow portions of the submerged continents thereby creating a mixed assemblage of deep and shallow water foraminifer deposits—such as we find at the Little Stave Creek section. This same process occurs even today and is most pronounced in association with storm activities (e.g., Collins et al., 1999; Scott et al., 2001; 2003).

The use of palynologic (i.e., spores and pollen) or plant leaf fossils to estimate climate or water temperature would suffer from the same inherent errors as the transported and mixed macro- and micro-fossilized fauna. The transport and eventual deposition of these plant materials would have mixed in a manner that would preclude environmental interpretation. Plant remains were derived from antediluvian settings and could not define the climate during the Flood.

Erroneous Depth Indicators

It is highly questionable whether microfossils can establish sea-level changes within the young-earth Flood framework, especially since the Flood was a short-term event of high energy. Much more time would appear to be needed to create a relatively stable marine environment with well-established foraminifera ecological zones. Even if possible, modern mixing of deep and shallow water marine microorganisms during a hurricane demonstrates further problems with this approach. Clearly, these high-energy storm deposits are inconsistent with current uniformitarian expectations.

Mixed Sediments and Fossils

Interpreting much of the Little Stave Creek section as a series of storm deposits also would invalidate any uniformitarian paleoecological interpretation, since the resulting sediments and fossil shells would reflect a mixed deposit of life-forms not in their original habitat and likely not buried in their original sediments. This would explain why paleontologists CoBabe and Allmon (1994) failed to identify a vertical relationship between the invertebrate shells and why they identified the shell bed as a unique (i.e., worst case) depositional setting in which to conduct a paleoecological assessment.

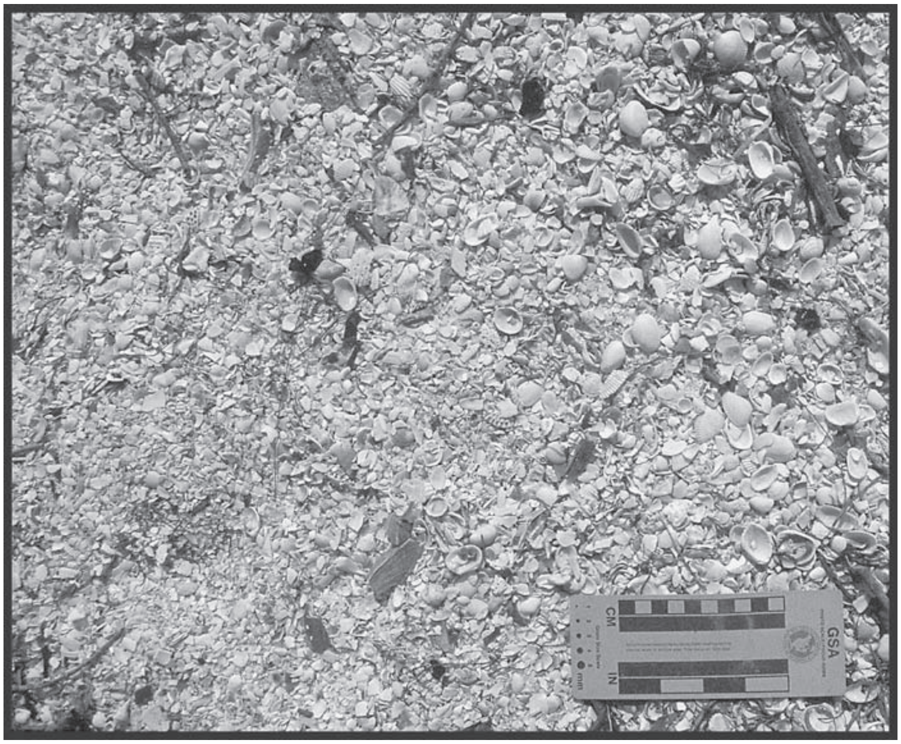

Figure 8. Sanibel Island, on the southwestern side of the Florida Peninsula, is famous to shell collectors. Wave conditions are such that a wide variety of shells are gently washed onshore, and in many cases they are in perfect condition. However, storm waves also serve to batter and break the shells creating a shell hash that if lithified would form a coquina. Such broken shell material can be seen in this image from the beach at Sanibel Island, where whole shells are mixed with broken shells. Note that both the shells and fragments are generally flat-lying. This modern shell deposit is not what is found at Little Stave Creek, so any postulated association between the two locales is inappropriate. Scale in inches and centimeters.

Correlating water depths to stratigraphic sections along Little Stave Creek also suffers when much of the rock record is defined as a series of tempestites. Again, the mixing of the original organic remains during deposition would create an inaccurate record of past water depth. This would be interpreted as a series of rapidly changing sea-level positions, ranging from beach to outer shelf, which is what is demonstrated at Little Stave Creek. From a Flood perspective, both the sediments and shells were derived from various source areas across the inner continental shelf. Clearly, the Gosport Sand was transported a very short distance and deposited in deeper water as a function of hydraulic processes. The nature of the shell deposit and bedding throughout the Gosport Sand reflects rapid deposition, likely by suspension, and not followed by any level of bioturbation.

In defining the paleo-depositional setting of the Gosport Sand, Gardner (1957) envisioned a battered beach environment for the coarse-grained and highly angular basal sand unit. But if this setting occurred over millions of years, then the beach sand should be more rounded and worn. Directly above this basal sand layer are the delicate shells beautifully preserved in completely random orientation. For this paleosetting, Gardner (1957) invokes a gentle, low energy surf that transported the delicate shells to the near shore, where they accumulated and were eventually buried with a rise in sea level. However, even in this low-energy setting, we should expect that over the course of millions of years some of the shells would have become broken, forming a coquina deposit (Figure 8). No coquina layer(s) are found in the Gosport Sand Member nor have any been reported by past investigators. Gardner's (1957) various uniformitarian paleosettings are not consistent with the expectations of a multimillion-year history for the development of the Gosport Sand Member.

If a hypercane created the Gosport Sand Member, could it also explain the reversal in flow direction in the Suwannee Channel that has been advanced to explain the sudden appearance of the echinoderm, *Echinocyamus*, in Gulf Coastal Plain sediments (Zachos, 2005)? The problem with linking these two events in this manner is that the equivalent age assumptions between this echinoderm and the Gosport Sand are based on evolutionary concepts inconsistent with the Flood framework. But if this time link could be demonstrated, then serious questions would be raised regarding the assumed uniformitarian time span over which the entire Gosport Sand was deposited.

The Fallacy of Sequence Stratigraphy

The application of sequence stratigraphy to the section exposed along Little Stave Creek provides only confusion. A close examination of the rock record at this locale reveals that a number of the proposed unconformity boundaries (both Type 1 and Type 2) appear to be absent. Additionally, many of the stratigraphic units have sediments inconsistent with sequence-derived eustatic cycles. It appears that the sequence stratigraphic framework has been forced on the rock record at Little Stave Creek. The result is a highly detailed but confusing subdivision of the stratigraphic units by questionable unconformity boundaries and implied changes in relative sea level (see Hazel and Pitakpaivan, 1993). The Gosport Sand Member sediments and fossils do not correlate to the sequence stratigraphic interpretation. It proves an excellent example of theory overwhelming evidence; purportedly long, slow changes in sea level interpreted from a stratigraphic unit that was deposited as a storm deposit. Invoking the principles of sequence stratigraphy to possibly enable a Flood interpretation for this entire stratigraphic section or just the Gosport Sand is of no use in this instance.

Multiple Storms

Was the Gosport Sand Member created during a single storm or from a series of storms? Evidence in support of its forming during the course of multiple storms spanning millions of years should include: (1) a succession of normally graded shell beds (or possibly non-fossiliferous high-energy cross-bedded sands) overlain by finer-grained clastics, (2) the bioturbation of the storm-derived sediment, and (3) sedimentary materials indicative of a condensed section (e.g., phosphatic nodules, hardgrounds). None of these features are present in the vertical profile within the Gosport Sand. Rather, the unit appears to be an interrelated sequence of sediments reflective of continuous sedimentation extending upward into the lower Moodys Branch.

Conclusions

The size and morphology of the Gosport Sand Member can best be explained within the context of a very large storm deposit. Even the lower portion of the Moodys Branch Formation also may prove to be a part of the tempestite. Based on the stratigraphic context, I believe that the hypercane passed over this submerged portion of southwestern Alabama during the Middle Flood Division (see Froede, 1995; 2007), moving toward the north-northeast. Extensive subaqueous and subaerial volcanism in western North America, Mexico, and possibly Central America could be a probable oceanic heat source that generated one or more hypercanes during this time interval. Additionally, meteoric impact events also within this area during this time could have supplied heat to both the atmosphere and Floodwater.

Hypercanes would have created extensive seafloor erosion through a combination of sediment resuspension and bottom-current flow. Sediments and shells were hydraulically sorted, transported short distances, and deposited in scoured depressions or low-lying areas across the former seafloor. Moving vertically up the Gosport Sand section, the succession of sediments along with the general decrease in shell materials reflects a reduction in sediment stirring and transport as the storm moved out of this area. The lateral thinning of the Gosport Sand Member both to the east and west of its area of maximum thickness across southwestern Alabama is consistent with the expectations of a storm deposit (see Morton, 1981), but likely on a scale too great for uniformitarian acceptance. However, a hypercane able to produce this massive tempestite is possible and probable within the time and energy expectations of the Flood framework.

Appendix

An interesting part of the computer modeling conducted by Emanuel et al. (1995) is the anticipated destruction of the protective ozone layer in the stratosphere. They stated:

> The injection of large amounts of water into the stratosphere may have significant consequences for the chemistry of that region. Water vapor is the source of the free radicals OH and HO_2, which contribute to stratosphere ozone depletion.... The OH radical plays also another important role: It activates chlorine (by converting the relatively stable HCl species to Cl atoms) and deactivates nitrogen (by converting nitrogen dioxide to nitric acid, a more stable species), the net effect being enhanced ozone depletion by chlorine free radicals.... An important separate effect of water on stratospheric chemistry could result from the formation of clouds: Chemical reactions on cloud droplets activate chlorine and deactivate nitrogen oxides, in a manner analogous to that described above for the OH radical. Such a mechanism explains the formation of the Antarctic ozone hole (Emanuel et al., 1995, p. 13762).

Perhaps the rapid decline in the human life span following the Flood might correlate to the loss of a pre-Flood vapor canopy *and/or* the loss of the protective ozone layer in the stratosphere. Humans would have been exposed to damaging radiation from sunlight until the protective ozone layer was able to re-form—a period of time likely extending over many decades. Could this be a reason that humans do not live as long on the earth today as their pre-Flood counterparts? This might prove to be a fruitful area of further research for young-earth creation scientists.

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Book Review

Investigating Evolution: A Six Part Educational Series

A DVD produced by Coldwater Media, 300 General Palmer Drive,
Palmer Lake CO 81033, 2007, $20.00.

This DVD, which runs for 33 minutes, is composed of modules covering six topics—Embryological Evidence for Evolution, Galapagos Finches, Four-Winged Fruit Flies and Morphological Mutations, Antibiotic Resistant Bacteria, Homology, and The Cambrian Explosion. Topics are explained and discussed by informed scholars, most prominently Jonathan Wells. Most of the scholars are opposed to large-scale evolution.

There are appropriate animations—for example, flies with two wings and with four wings. Attractive full color is employed. The longest module (11 minutes) is the final one and features discoveries of Cambrian fossils in China. Scientists there report finding 136 different kinds of animals and say these represent Darwin's tree, but it is upside down!

I feel that this DVD could be very useful for a discussion in classrooms and meetings with an audience having some familiarity regarding creation topics.

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The Heavener Roadcut: Deltaic Environment or Flood Deposit?

Mark W. Allen*

Abstract

The Hartshorne Formation in Oklahoma has been interpreted as being deposited in various delta-type environments. A better explanation would be that the strata were deposited in a catastrophic environment as illustrated by cross-bedded sand units and a significant amount of plant material. The plant material likely was derived from a floating forest, and its fossil remnants are now found as upright tree casts and molds, along with carbonaceous layers of plant debris and coal.

Introduction and Site Location

The Heavener roadcut exposes two formations: the Atoka Formation and the overlying Hartshorne Formation. This exposure of the Hartshorne Formation probably has been visited by more geologists than all other Hartshorne Formation outcrops in Oklahoma combined. The accepted uniformitarian interpretation (Suneson and Hemish, 1994) is that the exposed strata in the roadcut were deposited in interdistributary marshes and swamps in a delta-plain environment. Over the years, this exposure has been interpreted in many ways (see below), ranging from fluvial-deltaic to marine settings. A better explanation is that the strata were deposited by flood processes.

The roadcut is located along U.S. Highway 59/270, approximately two miles south of Heavener, Le Flore County, Oklahoma (Figure 1). Structurally, this outcrop is in the southern part of the Arkoma basin in eastern Oklahoma. Situated on the south flank of the Pine Mountain syncline, the roadcut is approximately one mile north of the trace of the Choctaw thrust fault, which is the leading imbricate fault of the Ouachita Mountains. Beds in the exposure dip approximately 30 degrees to the north but are otherwise undisturbed.

The Hartshorne Formation is the basal Desmoinesian (Middle Pennsylvanian) unit in the Arkoma Basin of Oklahoma and Arkansas. The Hartshorne Formation conformably to disconformably overlies the Atoka Formation and is generally conformable to the overlying McAlester Formation, which is missing at the study site. The Atoka Formation is visible on the southern end of the roadcut and consists mostly of black to gray shale. The Hartshorne Formation consists of sandstone, siltstone, shale, coal, and rare conglomerates (Suneson, 1998). In general, the formation forms a ridge bordered on both sides by valleys underlain by the shale-dominated Atoka and McAlester Formations.

Uniformitarian Interpretations of the Hartshorne Formation

Many geologists have interpreted the depositional environment of the Hartshorne Formation.

- Suneson and Hemish (1994) state that the strata were deposited in interdistributary marshes and swamps in a delta-plain environment. Coal beds represent periods of peat accumulation with little or no sediment influx; shale intervals represent periods of slightly greater clastic sedimentation; and the sandstones are overbank and/or crevasse-splay deposits that probably represent periods of flooding.
- Suneson (1996) indicates that the *Calamites* casts at this locality are comparable to modern

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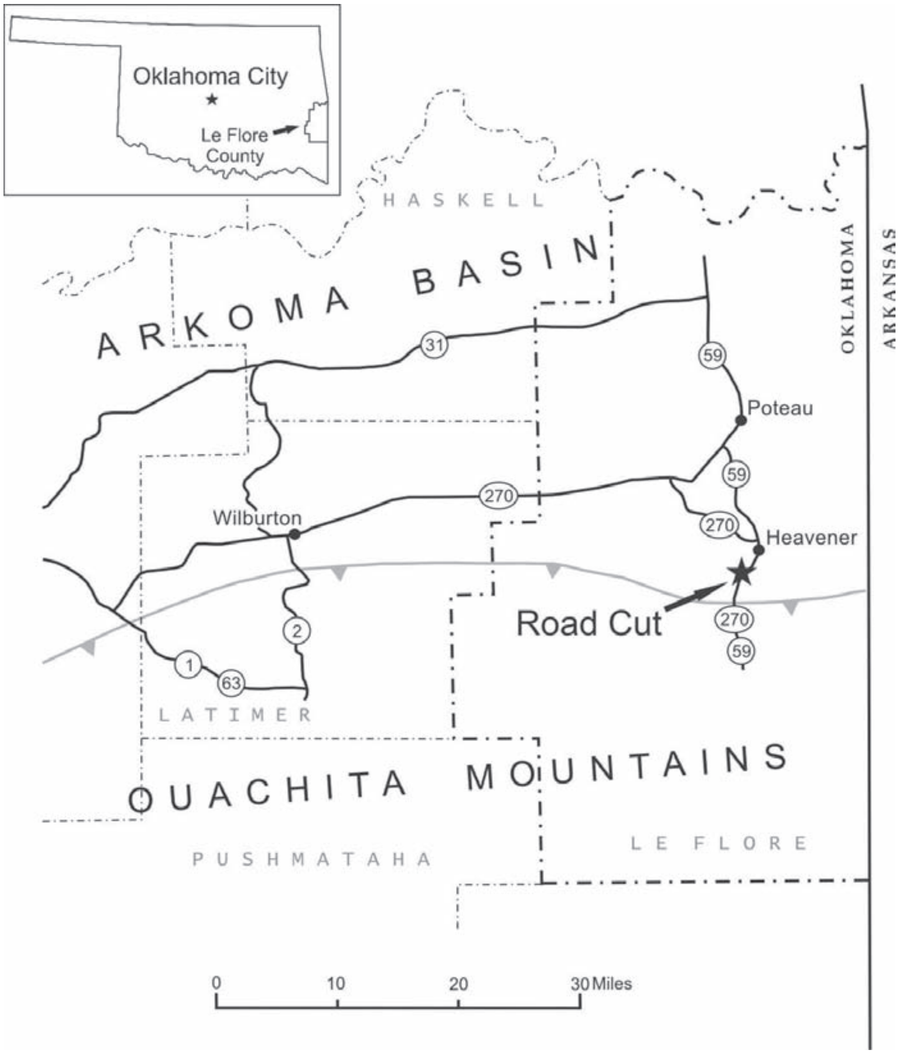

Figure 1. Location of the Heavener roadcut, Le Flore County, Oklahoma (Section 36 of Township 5N and Range 25E, NW, SE, NW) just north of the Choctaw thrust fault, separating the Ouachita Mountains and the Arkoma Basin.

plants found in swamps and along streams.

- Slatt et al. (2005) state that the Atoka Formation at this locality consists of bay-fill shale and marsh (coal) deposits. The overlying, lowermost sandstone of the Hartshorne Formation varies from marine bar to incised-valley fill to delta-plain crevasse-splay and bay-fill deposits.
- Roberts (1987) interprets this section to represent various delta-plain facies.
- Suneson (1998) summarizes previous interpretations based on the different lithofacies associated with the Hartshorne Formation. He states that most studies have focused on its depositional environment within a delta system. Workers recognized the many abrupt lateral facies changes within the Hartshorne Formation and related the different lithofacies to sedimentation on different parts of a delta. The different lithofacies include
    - Prodelta facies
    - Distal-bar subfacies of the delta-front facies
    - Distributary-mouth-bar subfacies of the delta-front facies
    - Frontal-splay subfacies of the delta-front facies
    - Interdistributary-bay/tidal-flat facies
    - Crevasse-splay facies
    - Marsh-swamp facies
    - Fluvial facies
- Suneson (1998) also summarizes other workers' interpretations from an overall basin perspective. These workers concluded that in eastern Oklahoma, the Lower Hartshorne Member consists of a delta-front facies overlain by two west-to-southwest-trending, relatively narrow distributary channels, separated by widespread interdistributary-bay deposits. In the western part of the Arkoma Basin, strata of the distributary-channel facies are relatively thin and narrower to the east and show repeated bifurcations. The interdistributary facies is widespread, and the delta-front facies is absent. The Upper Hartshorne Member is generally similar to the Lower Member, except that a delta-front facies has not been recognized. In Oklahoma, the prodelta shale of the Atoka Formation is widespread, as is the marsh-swamp facies (Hartshorne coals).
- Suneson (1998), when again describing the Hartshorne Formation, makes two comments about the depositional environment. First, he states that the Hartshorne in the southern part of the Arkoma basin of Oklahoma is fluvial-deltaic in origin. Then,

in the next paragraph it is noted that despite the near absence of marine fauna, most of the exposed part of the Hartshorne Formation is marine, except in the eastern part of the Arkoma basin of Oklahoma, where parts of the upper Atoka contain coal. His statement then follows that it is possible some of the Hartshorne in the southern part of the Arkoma basin is not associated with deltaic processes, in which case it would be preferable to use marine-coast terminology.

- Finally, Suneson (1998) again states that nearly all workers have accepted the delta model, but in the next paragraph he makes the statement that most outcrops of the Hartshorne Formation in the southern part of the Arkoma basin in Oklahoma were deposited in a marine environment. However, as noted above, he states that the Hartshorne Formation in the southern part of the Arkoma basin is fluvial-deltaic.

Which one is it, fluvial-deltaic or marine? The general consensus from all previous workers is that the Hartshorne Formation is part of a vast delta system that existed in the Pennsylvanian. The issue is confused by stating that the Hartshorne in the study area is: (1) fluvial-deltaic; (2) marine, except in the study area where the underlying Atoka contains coal; and (3) may not be deltaic in the southern Arkoma basin but rather a marine-coast environment. The depositional environment varies even in the same publication by the same author. The delta model is entrenched in the literature, and because few think outside the model, these obvious contradictions throw doubt on the interpretation. A close study of the rocks indicates that the strata were laid down in swiftly flowing water and upright tree casts found there are not relicts from trees that grew there.

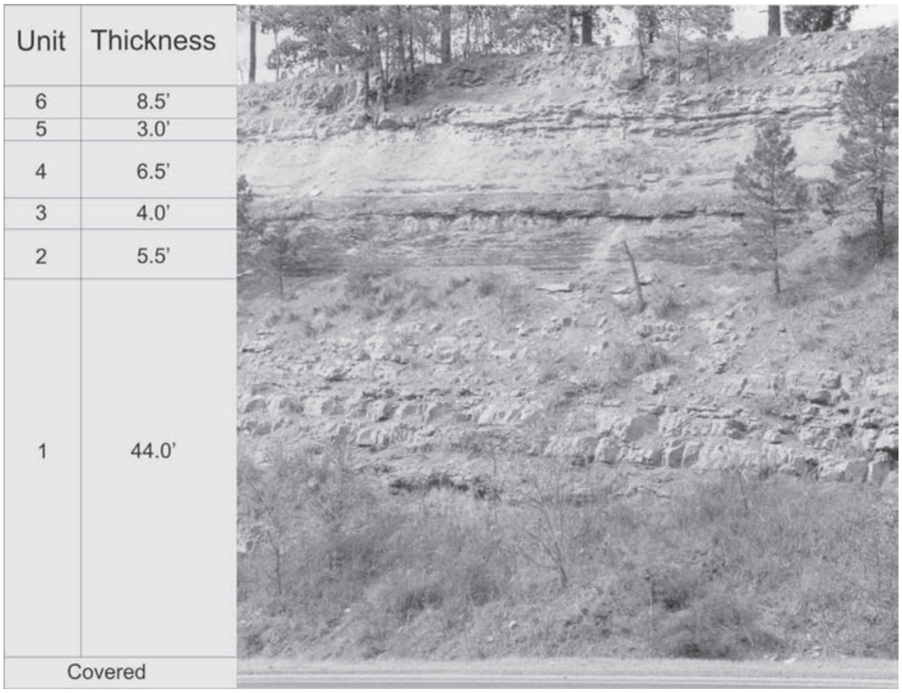

Figure 2. The Heavener roadcut showing the six-part division of the Hartshorne Formation based on rock type.

Evidences Favoring Catastrophic Flood Deposition

Commenting on the Hartshorne Formation, Suneson and Hemish (1994, p. 100, emphasis added) state that "the sandstones are overbank and/or crevasse-splay deposits that probably *represent periods of flooding.*" Evidence for this interpretation is not listed by those authors, but their interpretation may be derived from the abundant cross-bedding in the Hartshorne sand units, along with the paleocurrent direction exhibited by *Calamites* molds. These indicators will be discussed below.

Rock Units

Donica (1978) divides up the Hartshorne at this location into 20 different zones. Most of these come from subdividing the interbedded sands and shale units in the lower Hartshorne. For the current study, the exposure has been divided into six intervals based on rock type (Figure 2). From the base upward, we find:

- Unit 1: Interbedded light brown massive sand and shale.
- Unit 2: Black, jumbled, carbonaceous plant material.
- Unit 3: Black coal (Lower Hartshorne coal seam) with underlying gray clay (underclay).
- Unit 4: Black shale, grading upward to gray
- Unit 5: Sand, mostly tan with some gray and poorly cemented. Minor coal seams.
- Unit 6: Sand, light brown and massive.

Flow Indicators

Two primary flow indicators can be found in the strata. Units 1, 5, and 6 all exhibit extensive cross-bedding (Figure 3). The orientation of the cross-beds indicates that water flow depositing the sand was from south to north. Also seen in Unit 1 are *Calamites* molds, which can be seen in various orientations from vertical to horizontal (Figures 4 and 5).

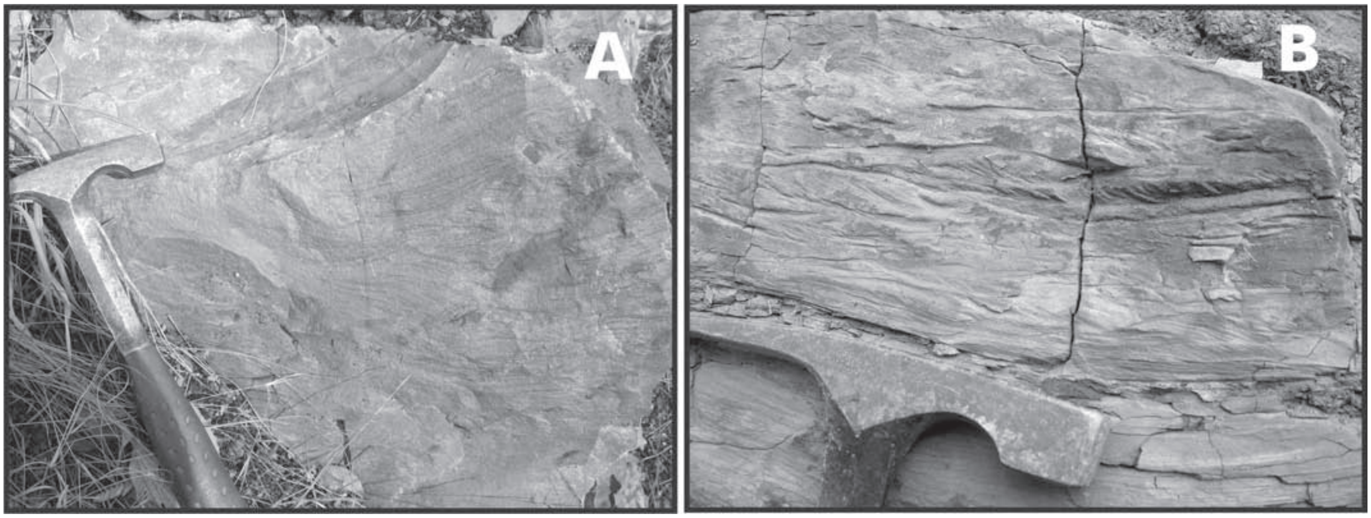

Figure 3. (A) Cross-bedded sandstone of Unit 1. Note the *Calamites* mold in a near-horizontal position. North is to the right. (B) Cross-bedded sandstone of Unit 5 showing flow direction from left to right (north). Rock hammer for scale.

These molds do not represent in situ plants. They were transported there from somewhere else by floodwater and then buried in sand that was also deposited by flowing water as illustrated by the cross-bedding. In addition, the lack of roots on all *Calamites* molds found in Units 1, 4, 5, and 6, along with the appearance of some molds being "dropped" into place (Unit 4, discussed below), support the idea that the plant material was not in situ.

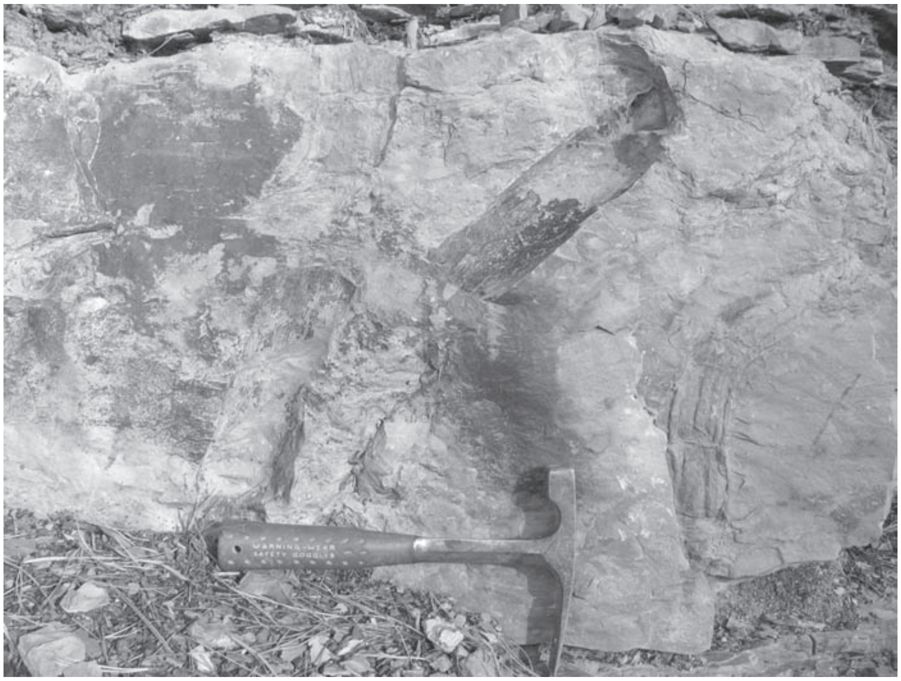

Figure 4. Calamites **molds in various orientations in Unit 1. Mold orientation and cross-bedding indicate water flow was to the north (right).**

Stigmaria Root

A *Stigmaria* root was identified in Unit 1, approximately three feet below the Lower Hartshorne coal seam. The exposed portion of the root is approximately 11 feet long, and the sand unit immediately above the root contains rootlets that extend upward from the *Stigmaria* root (Figure 6). *Stigmaria* is the generic name given to fossil root casts of various tree species of the Pennsylvanian Period, regardless of the form, genera, and species (Heib, 2006). The type of root found is mostly associated with *Lepidodendron*.

Stewart (1983) describes *Stigmaria* as being frequently found in the unstratified shale that represents the underclay of the original swamp. A seam of coal representing the decayed and compressed vegetation on the floor of the swamp usually lies on top of the stigmarian underclay. Wieland (1995) agrees that *Stigmaria* are generally underneath coal seams. Stewart (1983) suggests that they are in situ and were produced by the lycopods that grew in the ancient swamp that are now part of the coal seam.

Schonknecht and Scherer (1997) state the following about Carbonifer-

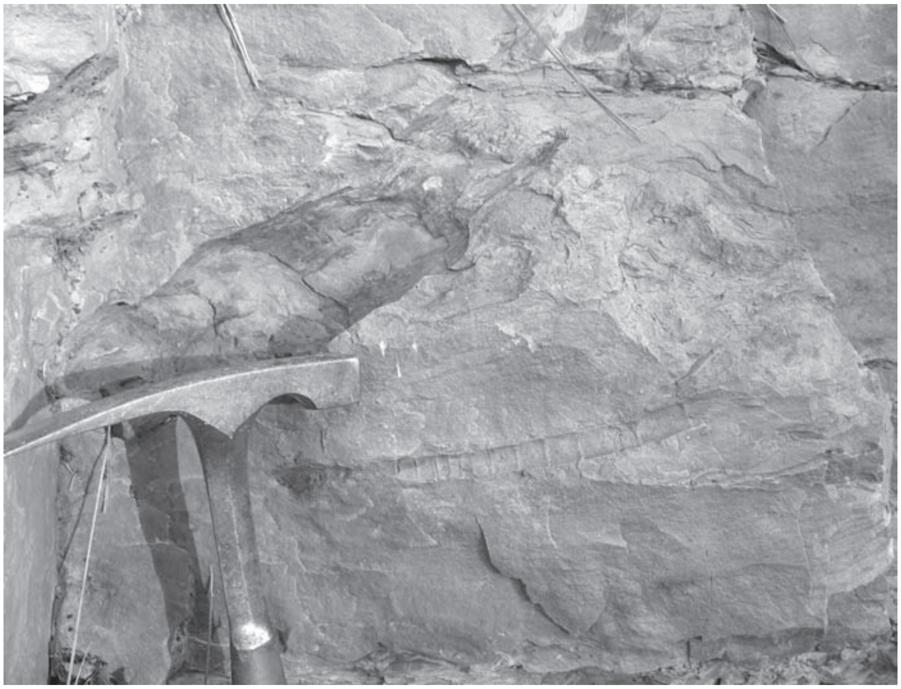

Figure 5. More *Calamites* molds from Unit 1. Note that the lower one is horizontal. Mold orientation and cross-bedding indicate water flow was to the north (right).

ous vegetation: (1) the anatomy of the vegetation (i.e., *Lepidodendron*) indicates floating plants, and (2) the vegetation had the characteristics of a floating forest, an alternative to swamp forests. The round nodes on the surface of *Stigmaria* are scars where ribbon-like rootlets were once attached and arranged radially about *Stigmaria* like the bristles of a bottlebrush. A radial root pattern is found only in water plants (Sarfati, 2004; Wieland, 1995). Water in soil moves downward under the influence of gravity, so roots growing in soil are designed to send their secondary rootlets in that direction, away from the soil surface. By contrast, the rootlets of plants floating in water grow straight out from the main root in all directions, just like the *Stigmaria* appendices (Wieland, 1995).

Discussion

Unit 1 is a 44-foot sequence of interbedded sand and shale that was deposited by moving water, as indicated by extensive cross-bedding, with the flow direction to the north. Donica (1978) divided this unit into 11 separate units based on interbedded sand/shale sequences. Unit 1 contains abundant plant material in the form of *Calamites* molds. The *Calamites* molds, which are mostly horizontal to subhorizontal, were transported into the area as illustrated by the lack of roots and the molds are completely encased in cross-bedded sand. Unit 1 grades vertically

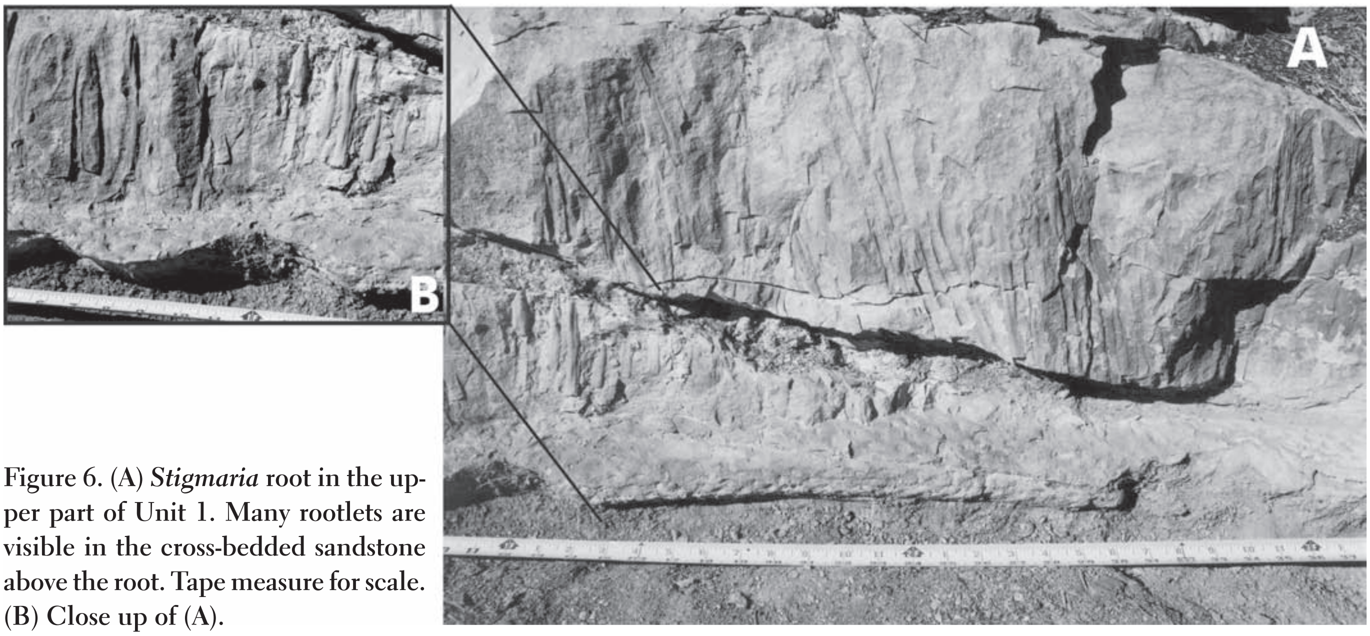

Figure 6. (A) *Stigmaria* root in the upper part of Unit 1. Many rootlets are visible in the cross-bedded sandstone above the root. Tape measure for scale. (B) Close up of (A).

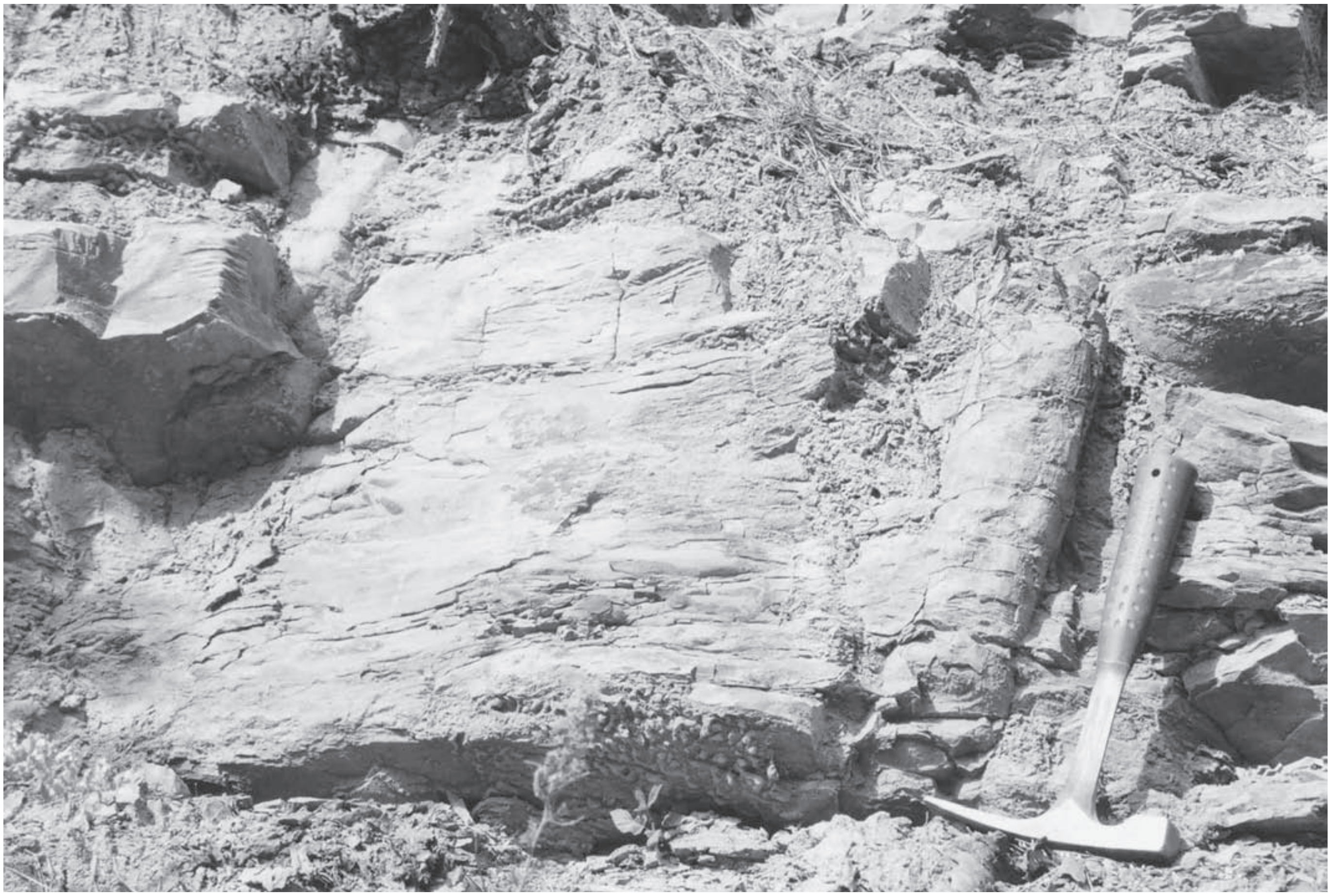

Figure 7. Two *Calamites* casts in cross-bedded sandstone from Unit 5. Rock hammer for scale.

from massive sand into thinly bedded, shaley sand.

Unit 2 is a 5.5-foot sequence of carbonaceous, black plant material, composed mostly of leaf remnants. The nature of this material suggests an abundant plant source that was catastrophically stripped of the foliage, jumbled together, and then buried. The carbonaceous plant material contains several thin coal stringers and infrequent nodules containing more plant material. Interestingly, Donica (1978) classified this layer as shale.

Unit 3 comprises the 4-foot-thick Lower Hartshorne coal seam that, like Unit 2, indicates a tremendous amount of plant material that was buried and transformed into coal. The coal appears to grade vertically into the overlying shale layer. Unit 4 is a 6.5-foot-thick shale sequence that was divided into three separate shale intervals by Donica (1978). The distinguishing feature of this shale is that it contains a three-foot-diameter *Calamites* cast that shows indications of being "dropped" into place. The large tree cast exhibits no roots, and the shale under it actually bends around the cast.

Unit 5 is 3-foot-thick sandstone with abundant cross-bedding and many upright *Calamites* casts (Figure 7). These casts also have no roots and apparently were transported to this location because they are encased in cross-bedded sandstone. Unit 6 is a sandstone layer approximately 8.5 feet thick with well-defined cross-bedding and few plant casts. Units 5 and 6 are very similar and almost indistinguishable from one another. The boundary was placed at a slight color change, a textural change from poorly cemented to massive, and a decrease in plant material.

All the evidence, which includes (1) the extensive cross-bedded sandstone, (2) the *Calamites* molds oriented from horizontal to subhorizontal, (3) the carbonaceous plant interval, (4) the coal seam, (5) the abundant *Calamites* casts, and (6) plant remnants having no signs of roots (with the exception of the *Stigmaria* root) and are therefore not in situ, points to a catastrophic depositional event and not processes associated with a delta environment. The *Calamites* molds in the sandstones of Unit 1 probably originated from a floating forest, being swept away and then buried by sand-laden floodwater. The presence of the *Stigmaria* root underneath the Lower Hartshorne coal seam fits into the floating forest model as described by Schonknecht and Scherer (1997). The fact that the rootlets are encased in cross-bedded sandstone suggests that they did not grow into the sand but were buried by the sand. As the floating forest was battered by the dynamic flood environment, the foliage would be stripped off, torn apart, and then buried, creating the carbonaceous layer (Unit 2) with abundant leaf impressions. The bulk of the floating forest eventually would become buried and converted into coal (Unit 3). A layer of clay (Unit 4) was then deposited over the coal, followed by more sand units (Units 5 and 6). Remnants of the floating forest that were not initially buried may have floated in the water for a time before they themselves became trapped and buried in sand (Units 5 and 6) and preserved as casts.

Conclusions

The various uniformitarian interpretations of the Hartshorne Formation clearly indicate uncertainty as to its depositional environment. This article provides evidence that the delta-type environment should be discarded in favor of a flood interpretation. Evidence points to a floating forest that was disrupted by water action and then quickly buried by sand in a catastrophic environment. Cross-bedded sandstones, in conjunction with significant plant debris (including coal seams), clearly illustrate that the Hartshorne Formation was not deposited in a delta-type environment. Various indicators point to swiftly moving water and rapid deposition. The location of the *Stigmaria* root supports the floating forest interpretation and contradicts the in situ explanation offered by Stewart (1983). The root and rootlets were not in situ, and the sand that encases the rootlets was deposited on top of the root and rootlets, burying them. This adds further support to the interpretation that the coal seam represents the remains of a buried, floating forest. *Calamites* casts and molds above and below the coal seam reflect remnants of the forest that were swept away and buried by sand.

Acknowledgments

I thank my wife Leilani for assisting me in the field and for her initial review and comments. I also thank my brother David for his assistance and discussion while at the study area. This effort has benefited greatly from constructive reviews provided by anonymous reviewers. However, any mistakes that may remain are my own. The ultimate purpose of this research is to bring glory to God and show His hand in Creation (Rom. 1:20; Job 12:8).

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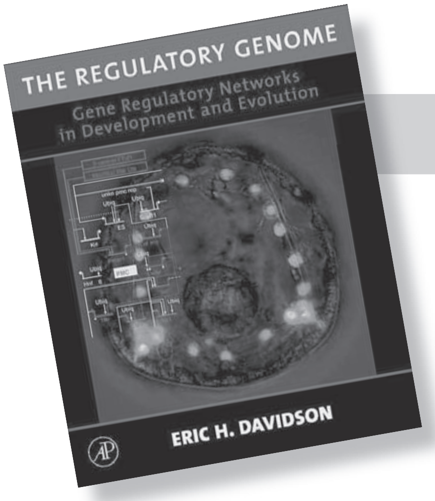

Book Review

The Regulatory Genome: Gene Regulatory Networks in Development and Evolution

by Eric H. Davidson

Academic Press, MA, 2006, 289 pages, $70.00.

Professor Davidson of California Institute of Technology is a pioneer in developmental biology, contributing to the field since the 1960s. This book endeavors to decipher the mysteries of animal development from laboratory findings in diverse models such as *Drosophila*, sea urchins, and mice. The author emphasizes the role of *cis*-regulatory DNA sequences in the unfolding of inherited information. However, spatial expression patterns of the earliest genes are determined by epigenetic information stored in the oocyte or surrounding maternal tissues in the form of mRNA or proteins. Once the initial anterior-posterior and dorsal-ventral polarities are established, groups of cells in different regions of the embryo will grow into body parts via cascades of gene regulation events.

Regulatory DNA sequences ("modules"), along with the genes, serve as nodes in information-processing networks made of interconnected divergent and convergent pathways, as well as feed-forward and feedback loops. The author uses computer program languages to illustrate the qualitative and quantitative logics of information processing. A section is entitled "*Cis*-regulatory Design" (pp. 61–78), and a subsection is dedicated to "*cis*-regulatory design and the creation of complexity in development" (pp. 73–78).

Numerous subcircuits are interwoven into one coherent program to execute the body plan. Four classes of subcircuits are described: (1) *Differentiation gene batteries* are deployed at the terminals of developmental networks. These are groups of functional or structural genes in fully differentiated cells controlled by common sets of transcription factors. (2) *Input and output linkages* are devices that serve as switches to operate subcircuits, such as *hox* genes that turn off limb development pathways. (3) "*Plug-ins*" are subcircuits that are repeatedly used in different locations within the same network and in different networks of diverse species. (4) *Kernels* are dedicated to one developmental process, such as heart formation, and are conserved among species. The nodes of the kernels are so interdependent that removing any one element would render the network nonfunctional.

The book consists of five chapters. In the last section of chapter 1, the author proposes that "the only way to obtain an explanation of animal diversity is by comparative analysis of developmental gene regulation networks in suitably chosen species" (p. 29). The bulk of the book explains development. Chapter 5 comes back to evolution. First the author observes, "Developmental gene regulatory networks are inhomogeneous in structure and discontinuous and modular in organization, so changes in them will have inhomogeneous and discontinuous effects in evolutionary terms…. The most important consequence is that contrary to classical evolution theory, the processes that drive small changes observed as species diverge cannot be taken as models for evolution of the body plans of animals. These are apples and oranges, so to speak" (p. 195). I understand this means that microevolution cannot be used as a model of macroevolution.

Subsequently, the author proposes that alterations in the four classes of subcircuits during evolution result in changes on different levels of the Linnaean framework (p. 195). Alterations in the periphery of gene regulatory networks are reflected on the species or genus levels, while alterations in the internal portions cause changes on higher levels. The bulk of chapter 5 describes how subcircuits are conserved. The last section of the chapter is entitled "Metazoan Origins and Gene Networks before Kernels" (pp. 235–240). The author points out in this section that "the diverse body plans of bilaterian animals since the Cambrian were and are all products of gene regulation networks of more or less equivalent complexity" (p. 235). He then proposes that the ancestors of Bilateria had a "developmental program consisting entirely of extremely shallow subcircuits" (p. 236), i.e., only differentiation gene batteries. To develop a gene regulation hierarchy, some of the regulatory modules must be simultaneously used for higher-level interactions. In the end, these regulatory sequences could have "escaped" from the differentiation genes. As an example of this process in action, *Pax6* is used both as an activator of visual differentiation genes and in the kernel for eye development. However, even though the same regulators are used on multiple levels, "the circuitry has changed as body part morphology has diversified." The author then writes, "Conditions permitting, there is inherent in this mechanism an explosive power of diversification" (p. 237), until the advent of kernel circuits locked down the process; thereafter "the penalty of circuit change is disaster" (p. 239).

Paradoxically, the author states in chapter 1, "a railway station and a cathedral can be built of the same stone, and what makes the difference in form is the architectural plan" (p. 16). Following this logic, even though all the components of a kernel are borrowed from other subcircuits—this is highly unlikely given the dedicated nature of kernel functions—the kernel would not be functional until all the wirings were reconnected. A partially connected kernel would offer no selective advantage and therefore the newly added *cis*-regulatory modules would degenerate.

Unfortunately, the author tells a different story. As he compares the developing embryo to "a delocalized computational device," he writes, "Given the components, the assembly of endless varieties of the computer would have followed … we can permit ourselves to imagine a strange juxtaposition: environmental selection operating on biological computer design" (p. 240). The implication is that there is neither designer nor programmer. It is all random assembly plus selection.

In all, this is an excellent book on development from an evolutionary point of view. With passion and marvel, the author describes the details of biological design using human design analogies. Since the developmental process challenges the classical evolution theory, "new principles" are offered for the mechanisms of body plan evolution. In the concluding pages, the author gives his best speculation as "a few stepping stones leading toward the ultimately interesting evolutionary issue."

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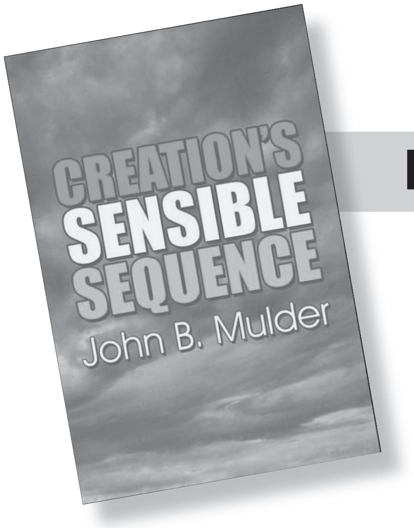

Book Review

Creation's Sensible Sequence

by John B. Mulder

Publish America, Baltimore, 2007, 82 pages, $10.00.

This small book provides a clear "walk through the creation week." Author John Mulder is a retired professor and veternarian living in Kansas. He effectively challenges the big bang and nonliteral creation days, while favoring traditional creation ideas such as the vapor canopy theory. Major emphasis is given to the practical, benevolent aspects of creation. Thus, mammals are useful for food, clothing, medical research, companionship, transportation, work, sport, hunting, protection, and entertainment (p. 44). A future book edition can clear up some problems: The ocean tides are not caused by earth magnetism (p. 32), the Milky Way galaxy is not recognized as the center of the universe (p. 34), and there are scores of known planets beyond the seven members of the solar system (p. 38). The book has no figures or index. It concludes with a clear gospel presentation. The author's website is www.jmulder.org.

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The Fungus Fossil Record: A Major Problem for Darwinism

Jerry Bergman*

Abstract

Fungi are complex life-forms that play a major role in modern ecology. A wide variety of fungal types exists from microscopic yeasts to large mushrooms. The estimated 100,000 species of fungi comprise approximately one-quarter of the earth's entire biomass. The fungus fossil record, which is examined in this paper, does not provide evidence of neo-Darwinism for the members of the Kingdom Fungi. As a result of this lack of evidence, speculation by Darwinists has resulted in many conflicting theories of fungus evolution, all unconstrained by fossil evidence.

Introduction

Fungi are highly successful life-forms. The atmosphere normally contains enormous numbers of their tiny spores, which are light and easily germinate on a wide variety of substances (Thomas, 1981, p. 30). Fungi are so common and widespread that they comprise an estimated 1.5 million species, fewer than 5% of which have been described, and 25 % of the biomass on the entire planet (Bruns, 2006; Moore, 1998). As a result, human exposure to fungi is ubiquitous. They are found in all ecosystems and show a great diversity of lifestyles (Redecker, 2002a).

Although approximately a hundred thousand species of fungi and molds have been identified by mycologists, less than 150 have been demonstrated to produce infectious disease and/or allergies in humans (Hiipakka and Buffington, 2000; Karunasena et al., 2000). The vast majority are ecologically and economically important (Ingold, and Hudson, 2000). They play many significant roles in nature everywhere some types exist (Brodo et al., 2001). Because some types cause health problems, the disease-causing fungi are often the best-known types. About 90% of all fungi found indoors are associated with the biodeterioration of plants, and a few of these fungus types can produce certain organic products that cause allergies. Some of the more common allergy-causing organisms include *Penicillium*, *Aspergillus*, *cladeosporium*, *Alternaria*, and *Aureobasidium*. A few fungi also produce mycotoxins that can result in a variety of adverse health effects.

Fungi include a wide variety of complex, usually nonmotile, filamentous, multicellular plantlike, spore-producing organisms characterized by the absence of chlorophyll. In terms of evolution, they are considered one of the most successful forms of life (Christensen, 1965). Lacking plastids and photosynthetic pigments such as chlorophyll, they cannot photosynthesize, and, for this reason, must utilize other organic matter (Brodo et al., 2001). Common examples of fungi include molds, mildews, yeasts, lichens, mushrooms, and toadstools. Fungi have several critical functions in ecology, including colonizing bare rock as the first step in converting unusable land to fertile areas that can support a wide variety of plant life. Their major role is to decompose and recycle organic waste materials produced by other organisms, notably lignin and cellulose (Taylor and Taylor, 1997, p. 83). This role is necessary for life to exist on earth.

Fungi also are critical as mutualistic symbionts of plants and animals. Yeasts are important in making a variety of foods, including bread, wine, and many other food products. Fungi are a major source of antibiotics, including those in the penicillin and griseofulvin families,

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and also of many other kinds of medicine (Kavaler, 1965).

Fungus Feeding Systems

Four basic feeding systems of fungi exist: *parasites* (those that grow in, and feed on, living tissues or cells), *epiphytes* (those that grow on the surface of other living organisms and use them for structural support only), *saprophytes* (those that live in and feed on dead plants or animals, their tissues, or products, such as seeds), and *mycorrhiza*. Saprophytic fungi play a critical role in breaking down or decomposing a wide variety of dead plants and animals, including wood logs, nuts, grass, and even animal dung (Sterflinger, 2000). A few fungi types (the parasitic fungi) live on living organisms, especially trees. The fourth type, the mycorrhiza, lives in a unique symbiotic association with the roots of plants. Redecker et al. (2000, p. 1920) conclude that some fungi, such as arbuscular mycorrhiza, played an important role in the success of early terrestrial plants.

Fungus Taxonomy

Fungal taxonomy has undergone numerous major changes during the last decade or so, partly due to the use of DNA sequence comparisons. The Kingdom Fungi now contains four main nonflagellated phylums, also called divisions, Glomeromycota, Zygomycota, Ascomycota, Basidiomycota, and the flagellated Chytridiomycota (James et al., 2006; Guarro et al., 1999, pp. 454–500). The current scheme of fungus is described in Table I. Most of the groups once called lower fungi—like the cellular and plasmodial slime molds, the oomycetes, and the hyphochytrids—are no longer classified as fungi, or even considered closely related to fungi (see Table II). For an older scheme of fungal phyla, see Table III. For an explanation of terms, see the glossary at the end of this paper.

Table I. The New Fungus Phylum Classification

1. **Phylum Chytridiomycota**, the chytrid, represent a group of primitive aquatic fungi characterized by having gametes called zoospores that are motile by means of flagella. They are the only members of the kingdom Fungi that produce motile cells sometime during their life cycle.
2. **Phylum Zygomycota** have unenclosed, or naked, sexual spores called zygospores that are not contained within a specialized fruiting body or sac. Zygospores form when the haploid nuclei at the ends of two hyphae fuse together to form a diploid zygote. The zygote then undergoes meiosis to form haploid cells that develop into zygospores. An example of a zygomycete is the common black bread mold, *Rhizopus nigricans*.
3. **Phylum Ascomycota** are also called sac fungi because their sexual spores (ascospores) are enclosed in tubelike sacs called asci. Ascospore formation is similar to that of zygospores, except ascospores are formed by meiosis enclosed in the asci. *Neurospora crassa* is an ascomycete mold important in genetic linkage studies.
4. **Phylum Basidiomycetes** are also known as club fungi, because their sexual spores (basidiospores) are produced from tiny clubs called basidia. Basidiomycetes include many of the more complex fungi, including mushrooms and puffballs.
5. **Phylum Deuteromycetes**, also called imperfect fungi, contain species for which no sexual stage has been discovered. Many parasitic fungi were once classified into this group but were reclassified when the sexual stage was discovered. An example of a deuteromycete is *Candida albicans*, a dimorphic fungus responsible for many human yeast infections.
6. **Phylum Glomeromycota** is a new fungal phylum known to be ecologically and economically important (Schüsler, et al., 2001). The Glomeromycota were part of the Zygomycota phylum but were removed on the basis of molecular, morphological and ecological characteristics (Schüsler, et al., 2001). They are mutualistic symbionts that form intracellular associations with the vast majority of tropical trees and herbaceous plants. They receive carbohydrates from their host and function as an extended root system, called an arbuscule, dramatically improving the plant hosts' mineral uptake (Redecker, 2005). The Glomeromycota phylum contains ten genera and approximately 150 described species.

The exception is the chytrids, which are still thought to be ancestral to all other fungi and retain what evolutionists assume are primitive fungal ancestor characteristics. It is also now believed that, except for the chytrids, fungi are more closely related to animals than to plants, algae, or any of the lower fungi as noted above (see Werner, 2003, pp. 1–5). Werner also reported that recent research findings have forced some surprising revisions in fungus taxonomy.

> Most notably, it has been demonstrated that the Zygomycota are not a real monophyletic group, but instead represent a polyphyletic assemblage of parts of at least four different lineages, including a lineage that does not belong to the Kingdom Fungi at all (Werner, 2003, p. 3).

Gene analysis also has resulted in other reclassifications. *Amoebidium*, for example, is a trichomycete that lives in the intestines of arthropods. Amoebidi-

Table II. The Lower Fungi (Lower fungi are fungus-like organisms that are not included in Kingdom Fungi by most modern taxonomists).

1.	**Plasmodiophoromycota,** also called **Phytomyxea**, are a group of protists that are parasites of plants. They typically develop within plant cells, causing the infected tissue to grow into a gall or scab (thus are endoparasitic slime molds). Important diseases that they cause include club root in cabbage and its relatives and powdery scab in potatoes.
2.	**Dictyosteliomycota** are eukaryote cellular slime molds. When water or food resources are limiting, they release pheromones as acrasin to aggregate amoebal cells in preparation for movement as a large (thousands of cells) bloblike mass called a grex, or "slug," that glides along on its own secretions, engulfing bacteria, fungi, and decaying organic matter for food as it travels.
3.	**Acrasiomycota** are eukaryote acrasid cellular slime molds related to protists. The name *acrasio-* comes from the Greek *akrasia*, meaning "acting against one's better judgment." Some mycologists consider Acrasiomycota a kingdom, because of conflicting molecular and developmental data, a debate not yet settled.
4.	**Myxomycota** are eukaryote true slime molds is a group related to protists. The name *myxomycota* comes from the Greek *myxo*, meaning "slime," and *mycota*, meaning fungus. They are also known as plasmodial or acellular slime molds. Some mycologists consider Myxomycota a kingdom because of conflicting molecular and developmental data.
5.	**Oomycota** are eukaryotes that include the so-called water molds and downy mildews. The 500 known Oomycota species are filamentous protists that must either absorb their food from the surrounding soil or they may invade another organism to parasitically live off of it. Oomycetes play a critical role in the decomposition and recycling of decaying matter. Oomycota means "egg fungi."
6.	**Hyphochytriomycota** are a small but important group of zoospore-producing organisms that look much like the Chytridiomycota except that they have flagella.
7.	**Labyrinthulomycota** are eukaryote net slime molds
8.	**Eufungi** are eukaryote nonciliated fungi, which, unlike other fungi, have unstacked Golgi cisternae
9.	**Chytridiomycota** (chytrids) are considered the most primitive fungi. They are mostly saprobic, and many are aquatic, living mostly in fresh water. The approximately 1,000 chytrid species use flagella to travel in their watery world.

Table III. An Older Fungus Classification.

Kingdom: Plants.

Subdivison D: True Fungi defined as thallophytes without chlorophyll

Class 1: Phycomycetes (Algal Fungi), vegetative hyphae usually without cross walls. Reproduces sexually by zygospores or oospores.

Class 2: Ascomycetes (sac fungi) has hyphae with cross walls and Ascospores formed after sexual fusions.

Class 3: Basidiomycetes (club fungi) has hyphae with cross walls and Basidospores formed after sexual fusions.

Class 4: Imperfecti (Imperfect Fungi), sexual reproduction unknown (from Wilson, 1945, pp. 278–279).

um was originally classified as a fungus but has been reclassified in the Mesomycetozoea, which are a small group of parasitic protists. Amoebidium are also closely allied to choanoflagellates. The mesomycetozoans and choanoflagellates form a clade that Werner believes to have diverged from the animal line at a point in animal evolution when the ancestors of animals had not yet strongly differentiated from the ancestors of fungi. Werner (2003) added that it is very likely that further analysis will reveal many other trichomycetes to be mesomycetozoans rather than fungi. In addition, according to Werner (2003), the majority of taxa once classified with the classic *Rhizopus* bread mold in the phylum Zygomycota are now in a lineage consisting of the core zygomycetes plus the Blastocladiales (which were once classified as chytrids).

The next most basal clade consists of the chytrids (excluding the Blastocladiales), plus several genera formerly classified as zygomycetes, including the genus *Endogone*. *Endogone* is the only known fungal taxon outside of the Ascomycota and Basidiomycota whose members can form ectomycorrhizae with plants.

The remaining zygomycete clade consists of certain mycorrhizal fungi that recently have been designated phylum Glomeromycota (see Table 1). This group is now considered to be a basal member of the same clade as both Ascomycota and Basidiomycota.

This revolution in taxonomy is largely caused by the use of gene comparisons for classification as opposed to morphology, which was the system used in the past (Guarro et al. 1999, p. 455). Werner (2003) concluded,

> This new understanding of the basal phylogeny of fungi throws much of our prior understanding of fungal evolution into disarray. When the chytrids were thought to be the most basal clade in the fungi, the evolution of a predominantly hyphal fungal morphology from a zoosporic one was thought to have taken place only once. It now seems that this evolutionary event took place at least three times, or perhaps there may have been several shifts back and forth between predominantly zoosporic life histories and predominantly hyphal ones. (p. 4)

DNA comparisons not only have forced a polyphylogeny theory on the older monophylogenetic zoospore theory but also have forced a major revolution on the phylogeny of all life-forms. One reason for favoring the polyphylogeny theory is the fact that molecular studies have found the so-called lower fungi are much more complicated than previously thought (Redecker, 2002a, p. 126).

Fungal taxonomy is still in a state of flux (see Tables 1 and 3), and the relationships of different groups within the main groups will likely continue to change, and some mycologists disagree with the classification described here from Werner (2003). Another problem is that what different mycologists consider to be a species can vary widely, and there are different approaches for delineating species (Guarro et al. 1999, p. 455).

The Phylogeny (Evolution) of Fungi

It was once believed that algae, lichens, mosses, and other primitive plants spontaneously generated from decomposing water (see Howe and Armitage, 2003, p. 247). Although the details have changed considerably, for the last century Darwinists have likewise taught that fungi evolved from some other simpler life-forms that originated by spontaneous generation (Padovan et al., 2005; Gaumann, 1952). It also was once believed that fungi are degenerate plants that lost their chlorophyll during evolution. Since genetic research on rRNA has indicated that fungi were never photosynthetic (Raven, 2002), it is now argued that they split off by evolution before plants had evolved chloroplasts.

Others argue that genetic symbiosis (the exchange of genes) better explains the evolution of fungi (Margulis, 1996). In other words, this theory argues that it is the lateral transfer of genes from one unrelated life-form to other unrelated evolutionary clads, causing unexpected similarities, that produced the variety and similarity we see today in the fungal kingdom. No direct evidence exists for the theory of symbiosis, although it is well established that viruses and other vectors can transfer genes and cause disease such as cervical cancer. Creationists attribute these differences to a designer, a view that is supported by the fact that these different genes are well integrated to the different organisms in which they are found.

The classical view proposed by mycologists and still accepted by many is that fungi evolved from chytridomycotes (chytrids) or similar organisms. Their ancestors are assumed to have been aquatic, either marine or freshwater, mostly single-celled life traditionally classified as protists. Other mycologists hold different views of fungi evolution. For example, Pearson (1995, p. 162) suggested that they evolved from extinct seaweeds in the order of solenoporales. Specifically, fungi are now commonly assumed to have originally evolved about a billion years ago from flagellated protists similar to present-day choanociliates (Moore, 1998). Confusion over their evolution is indicated by the fact that

> mycologists have long maintained that the fungi represent different phylogenetic lineages, probably evolving from different protist ancestors. A widely held and longstanding view of fungal phylogeny assumes that the chytrids, or organisms similar to the chytrids, were ancestral to the true fungi (Moore-Landecker, 1996, p. 245).

Although no accepted phylogenetic hypothesis exists for the evolution of fungi, one view is they evolved from flagellated cells (James et al., 2006). They also are commonly assumed to have evolved in an aquatic habitat and to have left this environment by becoming parasitic and living off of the first land plants (Heckman et al., 2001). To support this view, evolutionists point to evidence that some of the earliest known fungi coexisted with various organisms in nonmarine ecosystems (Gray and Boucot, 1993; Urbani, 1980). The moist tissues of their hosts would have shielded them from desiccation, allowing them to live on land (Neushul, 1974). Other researchers disagree, holding that fungi evolved on land and that some forms left the land and went into the water, where they evolved further.

Still others argue that different groups of fungi evolved separately in water and on land. Many researchers think that fungi evolved separately several times, producing the wide array of types existing today (Redecker, 2002a). Kendrick even assumed that fungi seem to have arisen independently in no fewer than fourteen families of agarics (2000). Another view fostered by James et al. (2006) claims that the ancestors of fungi are simple, aquatic forms with flagellated spores, similar to the extant Phylum Chytridiomycota (chytrids). This view indicates that fungi lost their flagella at least four separate times in evolution and the loss of swimming spores coincided with evolution of entirely new methods of spore dispersal (James et al., 2006).

The matter of determining the evolution of fungus as a group is a major problem because even the basic classification of Fungi

> has been a matter for considerable discussion and debate. Fungi, for example, were previously placed in the Plant Kingdom along with the photosynthetic plants. Now, the organisms studied as fungi by mycologists fall into three [different] kingdoms (the Protoctista, Chromista, and Fungi), but none are considered to be plants. Similarly, the phylogeny of the fungi themselves has been debated and various hypotheses proposed (Moore-Landecker, 1996, p. 245).

An excellent summary of the problems determining fungus phylogeny concluded that

> diagrams, evolutionary trees, and statements regarding the *course* of evolution and relationship among the higher categories are of necessity largely speculative.... Such phylogenic syntheses often vary with the individual biologist who proposes them, and they are subject to continuing modification as new evidences become available (Bold et al., 1987, p. 5).

Bold et al. (1987) concluded that the most trustworthy evidence on which evolutionary relationships can be postulated is the fossil record and the comparative morphology of both extinct and extant organisms. We will now turn to that evidence.

Fossil Evidence

To demonstrate an evolutionary origin of fungi requires fossil evidence. Guarro et al. (1999) in a review of the literature concluded that currently little is known about evolutionary relationships among fungi and even the phylogenic relationships among higher fungal taxa remains uncertain, mainly because of a lack of sound fossil evidence. As a result, their phylogeny remains a source of much controversy.

The problem is not due to a lack of a fossil record. Fossil fungi are especially well preserved as permineralized remains or epiphyllous types (Taylor, 1993). Fossil fungi dated by evolutionists back to 600 million years by using their dating system have been found throughout the world, and many studies have been completed on these discoveries (Yuan et al., 2005; Sterflinger, 2000; Waggoner, 1994). Fossil finds include glomaleans (see Glossary) with an assigned date as far back as 720 million years ago. A diverse collection of fungi has also recently been unearthed in Scotland (Yuan et al., 2005). Many of those found were higher fungi, including Ascomycota and Basidiomycota groups (Rokas and Carroll, 2006; Redecker, 2006).

Aquatic fungi were some of the first fossil fungi reported from carboniferous plant materials, and chlamydospores are one of the most common fungal elements in carboniferous coal (Taylor and Taylor, 1997). So far, approximately 500 species and 250 genera have been discovered in the fossil record, and many are exactly like modern fungi, even with respect to their life cycle (Stewart and Rothwell, 1993).

The close similarity between fossil fungi and modern forms was noted by Arnold as far back as 1947. He documented the fact that the early fossil record includes well-preserved examples of both modern-appearing mycelium and spores (Arnold, 1947). Many fungi have been preserved in amber, and fine details have been preserved by the silicification of chert in which many fossils are embedded. Many different species of fungi, including yeast, have been preserved in amber, and the most common type found is saprophytic fungi (Poinar, 1992). Even well preserved fossil fungi living within host tissue (endogenaceous fungi) have been found (Stewart and Rothwell, 1993). Although most fossil fungi are small, even large fossil fungi (such as mushrooms) have been found in amber. All of the evidence discovered to date shows that nearly all of these fossil fungi are very similar to modern fungi and the rest are extinct.

In addition, fungi are found in the fossil record where they were living off the plants on which they live today. This indicates that the plant-fungi symbiotic or parasitic relationship has not changed much over time. For examples see Rodriguez et al. (1998).

Characteristics of the Fungus Fossil Record

The plant, fungus, and animal kingdoms are thought by many evolutionists to "have diverged from each other roughly a billion years ago" (Bruns, 2006, p. 758). They believe the fossil record of fungi dates back to over 650 million years ago (Moore, 1998). Fossil spores also are commonly found—the oldest have been dated back to about 601 million years ago—many of which are highly distinctive and extremely similar to present-day species (Moore, 1998). The major groups of fungi, including the Zygomycota (fungi producing a multinucleate zygospore; see Table 1), Ascomycota, and Basiomycota are thought to have diverged about one billion years ago because modern members of these divisions are found very early in the fossil record (Simon et al., 1993). Taylor and Taylor (1997) noted that research on fungus-host interactions indicates that most modern fungus groups extend well back into the Precambrian.

The oldest confirmed fungus discovered so far (a chytrid-like form) was found in northern Russia and has been given a date in the late Precambrian. Several other fungus groups can be traced back to strata that are classified as Paleozoic (Taylor and Taylor, 1997). All major groups of modern fungi have been found as far back as strata assigned to the Devonian. The primary method used to determine evolutionary phylogeny involves morphological traits such as spore characteristics, cuticle structure, and an evaluation of a variety of macroscopic features (Moore-Landecker, 1996). In one study alone about 500 fossil fungi were evaluated (Alexopoulos et. al., 1996).

Although an abundant fossil record exists for many fungi, there is no evidence to show their evolution from their putative evolutionary ancestors, a topic that has been much debated in the journals. For this reason, many mycology text authors include only a few paragraphs on the evolution of fungi, and some totally ignore the topic (see Ingold and Hudson, 2000). Other writers admit that fungi, bacteria, algae, and bryophytes all lack fossil evidence of any of their putative evolutionary stages (Scagel et al., 1984; Scagel et al., 1969). Scagel et al. (1984) noted that because of this lack of fossil evidence for neo-Darwinism, theories of the origins of fungal groups are always speculative, and are based upon inadequate factual information.

The same is true in publications from the 1990s. Stewart and Rothwell (1993) stressed that conclusions about the evolutionary original(s) and relationships of the major groups of fungi are speculative and often based on equivocal interpretations of the fossil evidence. Moore (1998) reported that most aspects relating to the origins and subsequent evolution of fungi are impossible to establish from any fossil record, so ideas and concepts must be gleaned from other sources. Their chitin skeleton seems to have showed up so suddenly in the fossil record that its appearance was called "dramatic" by Lowenstam and Margulis (1980).

A study of the fossil record reveals either essentially modern types or extinct forms of fungi (Stewart and Rothwell, 1993). Because their pattern of life and structure is in marked contrast to plants, a large number of transitional forms would be required to bridge fungi to other similar life-forms (Thomas, 1981). In the fossil record, for example, Redecker et al (2000) found that

> fossilized fungal hyphae and spores from the Ordovician of Wisconsin (with an age of about 460 million years) strongly resemble modern arbuscular mycorrhizal fungi (*Glomales*, *Zygomycetes*). These fossils indicate that Glomales-like fungi were present at a time when the land flora most likely only consisted of plants on the bryophytical level. (p. 1920)

Rikkinen and Poinar (2000) described a recent find of a remarkably well preserved fungus called *Chaenothecopsis bitterfeldensis* in Bitterfeld amber dating back to at least 20 million years ago (near the Miocene-Oligocene boundary) and possibly closer to 40 million years ago. They concluded that the fungi were strikingly similar to some modern species living in East Asia. Protein sequence estimates also date major modern lineages of fungi back to one billion years ago (Heckman et al., 2001). Even ultrastructural comparisons indicate ancient fungi are remarkably similar to modern forms (Stubblefield et al., 1985).

Poinar and Poinar (1994) add that their findings push back the time of the fossil record of glomalean fungi by 55 to 60 million years and also suggest that *these* fungi were present before the first vascular plants arose (p. 179). Typical of the fossil studies that have found either extinct or modern types in the fossil record is a review by Redecker (2002a):

> The Rhynie Chert [see Glossary] also contained a wealth of specimens from other fungal groups. Among them are a blastocladealean chytrid, strikingly well preserved and very similar to today's genus *Allomyces*. Another fungus has fruiting structures resembling today's Ascomycete groups of *Pyrenomycetes* or *Loculoascomycetes*. The quality of the specimens even led to distinguishing individual asci, the microscopic sac-like structures containing meiospores. (p. 128)

The Rhynie Chert beds in Aberdeenshire (northeastern Scotland) are important fossil sites that reveal a great deal about life in the Early Devonian (dated by evolutionists at approximately 408–360 million years ago).

Because of the lack of evidence for transitions, possible phylogenies of fungi require numerous assumptions and much speculation:

> Although no clear link exists between procaryotes and fungi, possible relationships occur between fungi, flagellates, and perhaps even red algae. It is widely thought that diverse ancestral flagellates have given rise to the lower fungi. These [as yet undiscovered organisms] are thought to have resembled the flagellated reproductive stages of existing Chytridiomycetes and Oomycetes…. These ancestral types are also assumed to have been able to use inorganic sulfur and nitrogen and to synthesize a wide variety of compounds. (Neushul, 1974, p. 178)

After noting that the phylogenetic history of fungi is based on little evidence and much speculation, Moore-Landecker (1996) admitted that the phylogenetic framework outlined by mycologists for over a century is a hypothesis that has become

> part of mycological history, whether or not it is factual in its entirety. Until molecular biology techniques were developed, there was little resolution about the validity of the proposed hypotheses. Arguments were particularly vehement about whether or not the red algae were ancestral to the Ascomycota. (p. 247)

One example of this hypothetical mycological history was summarized by a leading mycologist, Moore-Landecker (1996). After admitting that ancestral chytrids were much like their modern counterparts, he theorized that ancient chytrids lost their flagella and evolved zoospores. Then they gave rise to the Zygomycota, speculating that the most primitive Zygomycota

> might have been similar to *Mucor*, which forms large multispored sporangia. ...It is possible that the link between the phylum Zygomycota and phylum Ascomycota was made in the evolutionary transition of a fungus resembling our present-day *Endogone* into one resembling *Dipodascopsis*.... *Dipodascopsis* is a key organism, perhaps yielding the unicellular yeasts by reduction, and also giving rise to more advanced organisms as an extended dikaryophase was acquired. Once a dikaryophase had been acquired, the ancestral organism was much like our present-day *Taphrina*. *Taphrina*-like ancestors gave rise to the remaining members of the phylum Ascomycota as multicellular ascomata evolved. Evolution of the bitunicate ascus [also] occurred, probably producing a divergent line. (Moore-Landecker, 1996, p. 247)

Moore-Landecker (1996) concludes that it is currently speculated that Basidiomycota evolved from a *Taprhina*-like ancestor and that the Basidiomycota in turn

> gave rise to two lines. One was the primitive rusts, which may have been similar to the present-day *Uredinopsis*, a short-cycled rust that produces only teliospores and basidiospores, that in turn produced the modern-day rusts. The second line from the *Taphrina*-like ancestor led to a primitive member of the Auriculariales, which had a transversely-septate basdium, superficially resembling a mycelium, and sporadic clamp formation. The nonseptate basidium evolved, giving rise to the remaining members of the Basidiomycota, which also have diverse forms of basidiomata (p. 247).

Note that Moore-Landecker admits that his phylogeny is largely speculation. The current status of the evolution of fungi is identical to that noted by Thomas (1981) over 25 years ago—that the evolution of the fungi themselves is very difficult to unravel. For this reason evolutionary relationships are still very controversial (Padovan et al., 2005). In spite of the fact that very few fungi have hard parts, primitive fungi have been found in the earliest fossil-bearing rocks, the Precambrian cherts (Thomas, 1981). This fossil evidence does not support evolution; therefore scientists have used molecular data to try to infer phylogeny (Basgall, 2007; Moore, 1998). I am preparing a future paper that will review these fungal molecular data.

Recent molecular clock studies have produced results that are difficult to accommodate with the traditional interpretations of the fossil record of plants and fungi (Redecker, 2002a). Molecular studies also have found other conflicts with morphology-based taxonomy, such as molecular evidence supporting the conclusion that one fungus, which is currently put in two different families, actually belongs in another family (Redecker, 2002b).

Carlile et al. (2001) noted that biochemical studies sometimes confirm conclusions that had been reached on other grounds, for example that some of the organisms studied by mycologists are only distantly related to the mushrooms and toadstools. A problem is the majority of fungal species have never been the subject of physiological, biochemical, or molecular study, and with these morphological features remain the only basis for identification (see Carlile et al., 2001, p. 286). As more data come in, I predict that it not only will contradict our current assumptions about the fossil record, but also will contradict our assumptions derived from morphology. The difficulty in using genetic comparisons has motivated innovative ways of trying to understand the evidence, such as the hypothesized lateral gene transfer (the movement of genes from one type of fungus to other types).

Fossil Lichen and Mushrooms

A lichen is a symbiotic association between a fungus and an alga or a cyanobacterium. Although some evidence exists of Precambrian lichens and other fungi, the oldest unequivocal fossil lichen dates back to the Early Devonian (Heckman et al., 2001; Doerfelt and Striebich, 2000; and Taylor et al., 1995). Preserved in high detail, cyanobacterium shares numerous morphological features with several extant cyanobacteria (Raven, 2002). Study of this earliest fossil lichen found nothing to indicate that it was any less evolved than modern lichens (see also Howe and Armitage, 2002; 2003). Another fossil lichen assigned to early to middle Miocene (12–24 million years ago) bears a remarkable resemblance to *Lobaria pulmonaria*, a species that occurs in the area today (Peterson, 1999). Kendrick (2000) concluded that lichens have no common ancestor; only a widely shared symbiotic process that has arisen time and time again as a result of natural affinity, opportunity, or need.

Different mushrooms manifest a very wide variety of morphological forms. The common names for the basic types of mushrooms are boletes, agaric chanterelles, tooth polypores, puffballs, jelly fungi, bracket fungi, stinkhorns, and cup fungi. One mushroom (*Corprinites dominicana*) found in Dominican amber is considered to be the best-preserved mushroom fossil (Poinar and Poinar, 1994). Its delicate scales, and even its spores, are very well preserved (Poinar and Poinar, 1994, 1999).

Even some rotifers (small invertebrates) living in the mushroom gills located beneath the cap, and mites on the cap, were both still well preserved (Poinar and Poinar, 1994). The oldest mushroom trapped in amber has been dated at 90 to 94 million years old (Redecker, 2002a). Its morphology is so similar to modern forms that Redecker concluded it shows all the characteristics of today's Basidiomycete genera *Marasmius* or *Marasmiellus*. Such excellent preservation argues for very rapid fossilization.

Various Types of Fungi Are Radically Different from Each Other

Fungi were once classified as plants but now are recognized as so widely different from plants that they have been put into their own separate kingdom called Kingdom Fungi. The different types of fungi are so diverse, even within one classification, that they are often also grouped into *threadlike fungi* (bread mold), *club fungi* (mushrooms, puffballs, and bracket fungi that grow on rotting logs), and *sac fungi*, including yeasts, mildews, and morels. Even these groups are so different from each other that difficulties exist in finding or imagining credible intermediates. Some fungus types even can live in very hostile environments, such as under snow in cold parts of the earth. The number of species is enormous. One authoritative guide lists almost 5,000 species of mushrooms in North America alone, including many types that are very different from other mushrooms (Bessette et. al., 2000; see also, Phillips, 2005). The stark contrasts between these basic types of fungi should be accompanied by many unambiguous transitional forms in the fossil record, but after over a century of intensive looking, none has yet been found.

In spite of the many fossils found so far, Gamlin and Vines (1987) noted that almost nothing is known about how fungi evolved since no fossil evidence exists for their evolution. They also expressed the belief that the origin of fungi is polyphyletic, that is, fungi include several separate lineages, each of which evolved independently. The reason for this assumption is that modern fungus types differ so widely from each other that no one common ancestor is a feasible ancestor for all of them. Molds are as different from mushrooms as insects are from mammals. As a result of these contrasts evolutionary relationships of

> fungi to each other and to other living plants and animals are unclear, although ultimately they may have descended from some simple single-celled flagellated ancestor. The evolutionary relationships of the several classes of fungi have not been established. They may have evolved from one or another of the algae by taking up heterotrophic nutrition and losing chlorophyll. Alternatively they may have descended directly from primitive heterotrophs without ever passing through an autotrophic stage.... Finally, the evolutionary origin of the basidiomycetes [mushrooms and toadstools] is truly shrouded in mystery, for they show no relationships with any of the algae (Villee and Dethier, 1976, pp. 360).

This 1976 conclusion of Villee and Dethier is still valid today. Because current evolution theories are unconstrained by fossil evidence, many widely differing opinions of fungus origins are now held by experts. Most long-held theories of fungal evolution have not been supported by modern research findings. For example, it was once widely believed that algae were the ancestors of the true fungi, but this is now a discredited idea (Gamlin and Vines, 1987). Although some scientists still believe that oomycetes evolved from algae, other experts disagree with that conclusion (Gamlin and Vines, 1987).

Summary and Conclusions

We might expect that if fungi evolved from some primitive ancestor, the abundant fossil record of fungi should contain clear evidence of fungus transitional forms documenting this theory. The fossil record is very clear: all fossil fungi are either of extinct types or of essentially modern forms. No convincing transitional fungus forms are found in the enormous fossil record known to exist. Arnold's (1947) conclusion that the fossil record has thrown no light on the problem of the evolution or origin of the fungi, although made more than a half century ago, is still true today.

A diagram of the fungus fossil record shows a creationist orchard instead of demonstrating a tree spreading from one common ancestor. Fossils appear and sometimes disappear, but they do not evolve into other very different types of fungi (see Taylor, 1993, pp. 10–11). Furthermore, fossil research has verified Arnold's conclusion that throughout the long geological past, fungi have played the same role in nature as at present, that of acting as scavengers and thereby preventing an endless accumulation of dead vegetable matter (Arnold, 1947). This supports the intelligent design argument that fungi had an important role from the beginning of creation.

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Glossary

Agarics fungi, also known as gilled mushrooms for their distinctive gills, are usually referred to as toadstools and mushrooms. They are a large Class of Basidiomycetes.

Agrobacterium is a genus of bacteria that causes tumors in plants. The most commonly studied species in this genus is *Agrobacterium tumefaciens*. Agrobacterium is comparatively effective in transferring DNA between itself and plants, and for this reason is an important tool for plant genetic engineering.

Arbuscular mycorrhizae are mycorrhizal fungi that penetrate the cortical cells of vascular plant roots. They are the most common type of mycorrhizae on earth. Ninety percent of all plant families contain *Arbuscular mycorrhizae* species.

Blastocladiales are fungi that reproduce asexually by thick-walled spores that produce zoospores upon germination. Sometimes placed in class Oomycetes, they are saprobes and parasites that live off of a broad range of substrates, especially decaying fruits (e.g., rose hips) and partially decorticated twigs.

Chert is a type of fine crystalline quartz that occurs in veins throughout the rocks in Rhynie Scotland. Rhynie fossils were preserved when mineral sediments settled on top of them, effectively preserving them. As a result, this area of Scotland is a major source of small fossils.

Chlamydospores are the thick-walled spores of several kinds of fungi. Spores are a multicellular life stage that can survive in unfavorable conditions, such as in dry or very hot environments. They are the basic reproductive unit of a fungus. Chlamydospores are usually spherical with a dark-colored, smooth (non-ornamented) surface.

Choanoflagellates are a group of small single-celled flagellate protozoa found in both fresh waters and the oceans. They are considered by evolutionists to be the closest living relatives of animals and the last unicellular ancestors of animals. They have a single flagellum, surrounded by a ring of closely packed slender fingerlike projections (microvilli) that form a cylindrical collar, which is the source of their name ("collar-flagellates"). The actin-filled protrusions are microvilli that surround the single flagellum by which choanoflagellates both move and take in food. Evolutionists believe choanoflagellates must have existed on the earth since the Late Precambrian, because they are believed to be the closest living protist relatives of the most primitive metazoans, sponges. No fossil record exists of choanoflagellates, although some marine choanoflagellates secrete an outer covering made of fine, interwoven silica bars called loricae that would be expected to be preserved in the fossil record.

Choanociliate is another term for a choanoflagellate.

Chytrids is an older classification term referring to a group of fungi that were placed in the Class Phycomycetes under the Subdivision Myxomycophyta of the Kingdom Fungi. Also, in an older and more restricted sense the term "chytrids" referred only to those fungi in the order Chytridiales. The term Chytrid is now a common name for any small, simple life-forms in the phylum Chytridiomycota in the fungus kingdom.

Cyanobacteria are photosynthetic microorganisms that contain chlorophyll. Formerly called blue-green algae, the classification was changed because it has been shown they are more similar to bacteria than algae.

Epiphyllous refers to some life-form that is growing on, or inside of, a leaf.

Glomaleans is a term referring to a member of the phylum Glomeromycotan. See Table 1.

Hyphochytrids are uniflagellate fungus-like organisms that live in freshwater either as symbiotrophs of fungi or algae, or as saprobes that live on the carcasses of plant debris or on insects.

Mastigonemes are lateral "hairs" that cover the flagella of heterokont and cryptophyte algae. The approximately 15 nm diameter structures usually consist of a tubular shaft that terminates in even smaller "hairs." Their roles include assisting in locomotion by increasing the flagellum surface area.

Mesomycetozoea is a small group of heterogeneous microorganisms, most of which are parasites of fish, birds, and even mammals, including humans. The protozoon-like Mesomycetozoea are at the boundary between the animal and fungus "kingdoms." Because of conundrums such as this, dropping the "kingdom" rank for fungi has been seriously proposed by some taxonomists.

Mycelium is the vegetative part of a fungus, consisting of a mass of branching, threadlike hyphae. Hyphae are long, branching, and filamentous structures.

Oomycetes are the largest group of heterotrophic Stramenopiles (see below). They are facultative or obligate parasites found worldwide in fresh and saltwater habitats. Some terrestrial Oomycetes are important plant pathogenic organisms including Phytophthora of Irish potato famine fame, and Pythium, which causes seed rot and damping off.

Rotifers are microscopic, aquatic, animal life-forms in the phylum Rotifera. They are found in many freshwater environments and in moist soil where they inhabit still-water environments, such as lake bottoms and the thin films of water formed around soil particles, as well as flowing-water environments, such as rivers or streams. Rotifers also are commonly found on mosses and lichens.

Saprobic refers to an organism that is able to degrade chitin and keratin and utilize the nutrients. Saprobic organisms often feed on dead and decaying material as opposed to parasitic creatures that feed on living hosts.

Stramenopiles (also called heterokonts) are a major line of eukaryotes presently containing about 10,500 known species. As a group they have flagella with hollow or "strawlike" mastigonemes. Unlike the fungi, all members of this group have mitochondria with tubular cristae and synthesize lysine by a diaminopimelic acid pathway. Most are algae, ranging from the giant multicellular kelp to the unicellular diatoms, which are a primary component of plankton, and Oomycetes.

Trichomycete are a class of obligate fungi that grow in the alimentary canal, especially the intestine and stomach, of insects, crustaceans, and millipedes that live in terrestrial freshwater or marine habitats.

Notes from the Panorama of Science

Questioning the Origin of Mammals

In Brown (1998) I raised the question of whether or not marsupials laid eggs, and I gave reasons why this may have been the case. Adding to this is the fact that certain marsupials have no pouch and others have only a rudimentary one.

The marsupials' possible egg-laying nature was most certainly not inherited from any mammal-like reptile (Brown 2004) because there are clear and distinct gaps between mammal-like reptiles and mammals themselves. A New Scientist website article has the following comment: "The earliest known mammal fossil remains were unearthed in Texas, US, and date back 225 million years" (Young 2003). This adds to the evidence that marsupials did not inherit their egg-laying trait from mammal-like reptiles. If we allowed, for example, 5 million years for this Texas mammal to evolve, not an unreasonable evolutionary timeframe, this would put its evolutionary origin at 230 million years. But 230 million years before present (BP) would have been far too early for the origin of the first mammals. At about 230 million years BP there would have been no mammals but only the cynodonts, which were mammal-like reptiles thought to have been the ancestors of mammals!

Thus the Texas mammal fossil assigned a date of 225 million years BP is at least 25 million years before what has been considered to be the most likely time when reptiles evolved into mammals—it was far too "early" for evolution to have produced it, given the gap between mammal-like reptiles and mammals (Brown, 2006). At this stage I am tempted to say that the creation view has scored a victory.

Regarding the origin of mammals in terms of genetics, Brown (2004) discussed the function of genetic methylation and how genes can be "turned off" by adding methyl groups to the DNA, a process called "imprinting." Recently it has been shown that both birds and egg-laying mammals, such as the duck-billed platypus, lack imprinting, while marsupials and placental mammals have it (Jirle and Weldman, 2007). And although imprinting is present in both marsupials and placental mammals, there is enough difference in the imprinting systems they possess to support separate lines of origin for each of them as well.

Both the marsupials and the placental mammals have an evolutionary date of 125 million years BP. This supports them each being a different line of mammalian origins. The monotremes (egg-laying mammals) have never deviated from their egg-laying stage, and therefore the imprinting found in marsupials could never have come from the monotremes. The egg-laying trait found in marsupials could have come only from the marsupials themselves. So at this moment the information supports four unrelated lines: marsupials, placental mammals, monotremes, and fossil non-monotreme egg-laying mammals. This is certainly evidence that fits squarely with the creation concept.

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Notes from the Panorama of Science

The Fossil Jaw that Could Change Everything

A fossil has recently been discovered in Africa that is said to have been the jaw of *Homo habilis* (Anonymous, 2007). It is identified as 1.44 million years (my) before the present (bp) in the uniformitarian dating system. And a 1.44 my bp date for *H. habilis* would put it at the same "time" as the *H. erectus* fossils. The fact that *H. habilis* and *H. erectus* are thus made contemporaneous by this new fossil jaw conflicts with the existing theory that *H. habilis* was somehow the evolutionary ancestor of *H. erectus*. Even worse for that theory, Calder (1984, p. 141) had previously dated *H. erectus* even as far back as 1.9 my.

Fred Spoor, one of the people involved with this recent jaw discovery, said that the new jaw makes it hard to see *H. habilis* giving rise to *H. erectus*. Spoor also wondered what creature might then have given rise to *H. erectus* if *H. habilis* did not (Anonymous, 2007, p. 10).

H. habilis thus could no longer be placed in the evolutionary line leading to *H. erectus* and would be out of the ancestral picture. Furthermore, there is no way that *Australopithecus* could have given rise to *H. erectus* by a large evolutionary leap. So, this new jaw leaves open the prospect that *H. erectus* may have branched off from *H. sapiens*.

I have asserted that some form of *H. sapiens* yielded all other human types (Brown, 2004, 2005). This questions the time frame and order in which evolutionists have placed the fossils involved with mankind. But such changes in the time and order are nothing new. For example, the Ngandong skulls from Java were originally dated at 250,000 years bp, but are now assigned a mere 27,000 years bp (Brown, 2005). So, it is quite possible that the order and time frame of various hominid fossils will be rearranged and that *H. sapiens* will be seen as the original type of man.

In defense of the origin of *erectus* from *habilis*, some evolutionists are now saying that the date of 1.9 my bp for *H. erectus* in Africa must be inaccurate (Holmes, 2007, p. 12). This claim of inaccuracy is made so that *H. erectus* could again become younger than the 1.44 my date given to *H. habilis* and the original theory of *habilis* having given rise to *erectus* could be salvaged. But this recently discovered jaw might be evidence to support my creation model idea instead: that *H. sapiens* was the original form of man from which all others arose.

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Computers and the Human Mind

Will a computer artificial intelligence ever be on the same level as the human mind? I would say no. No matter how accurate or large its memory, no digital computer can program abstract mathematics, nor can it find such truths as can the human mind, said Malcolm Longair (Penrose, 1999, p. xvi). As the name implies, a computer is based on a computational system. So no typical computer in the form of an artificial intelligence will ever be on the same level as the human mind. God's creation wins over any man-made intellect.

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Letters to the Editor

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Comments on “Modern Cosmology: Science or Folktale”

Big bang cosmology seems to be considered by many as a unique, proven model of the origin of the universe because it provides an explanation for observed phenomena such as the red shift and the cosmic microwave background. In recent years I have had a growing interest in understanding this subject well enough to discern between real science and pure speculation.

As a result of this interest, I was particularly fascinated by an article that appeared in the latest issue of *American Scientist* (Disney, 2007). The author, Professor Michael J. Disney, an astronomer at Cardiff University in Wales, provides an interesting overview of the dilemmas facing current cosmological theory as he sees them. The purpose of my letter is to summarize the points made by Professor Disney.

As he explains, current “Big Bang cosmology is not a single theory; rather, it is five separate theories constructed on top of one another” (p. 385). He used the analogy of the floors of a building, which I will follow here.

The ground floor is expansion, which is historically rooted in general relativity. Einstein realized that general relativity implied that the universe is either expanding or contracting. Finding this unacceptable, in 1921 he came up with the cosmological constant, a free parameter he used to balance the universe. However, shortly after that in 1929, Hubble and others measured galaxy redshifts that pointed to an expanding universe. Much later in 1965, the cosmic microwave background was discovered. It was found that it could be interpreted as a remnant of the radiation from the hot gasses of a hot, dense, early stage of the universe. According to the author, this led to nearly universal acceptance of what Fred Hoyle dismissively called the “Big Bang” (p. 383).

The second floor is a solution to the horizon and flatness problems. It was noticed by Robert Dicke that opposite sides of the cosmos looked very much the same, even though they had never been sufficiently close to equilibrate. Even light was too slow to enable any information to travel between them. The problem was “virtually unadmitted” (p. 384) until 1981 when Alan Guth proposed the concept of inflation: a slow start to expansion, followed by a rapid acceleration. Inflation provided a solution to the horizon paradox. The author first describes inflation as a “moderately well-supported hypothesis” (p. 385) and then goes on to explain how it completely fails a test proposed by Richard Tolman in the 1930s. Tolman calculated that highly redshifted galaxies would fall off in brightness dramatically due to inflation. Recent observations by the Hubble Space Telescope have shown this prediction to be wrong. In fact, there was great surprise “when every deep Hubble image turned out to have hundreds of apparently distant galaxies scattered all over it” (p. 385). The Tolman test failed.

The third floor relates to a discovery in the early 1980s that galaxies are spinning far too rapidly to be held together by the mutual gravitational tugs of their observable contents. The solution was to postulate the existence of dark matter. This unseen matter must be greater in quantity than ordinary visible matter to solve the dilemma.

The fourth floor relates to the extreme uniformity of the cosmic background radiation. It is difficult to see how the present uneven structure of galaxies and clusters could result from such a smooth beginning. The answer is another form of dark matter. The primordial seeds of galaxies must be a special type of dark matter that clumps together and ignores radiation. It is called cold dark matter. The author states, “By the 1980s the theoreticians’ universe was entirely dominated by such invisible material” (p. 384).

The fifth floor results from observations of distant supernovae in the late 1990s that surprisingly suggest that the expansion, rather than being slowed by gravitation as expected, has instead accelerated. Again quoting the author, “The physics responsible for this seeming acceleration is entirely unknown and goes under the deliberately inscrutable name ‘dark energy’” (p. 384).

Finally, the author is concerned with free parameters. The currently fashionable concordance model of cosmology, also known as Lambda-Cold Dark Matter, has 18 parameters, 17 of which are independent. Of these, 13 are well fitted to observational data, and the other four are floating. He states, “Any theory with more free parameters than relevant observations has little to recommend it” (p. 384).

I particularly appreciated his final paragraph:

> The historian of science Daniel Boorstin once remarked: “The great obstacle to discovering the shape of the Earth, the continents and the

> oceans was not ignorance but the illusion of knowledge. Imagination drew in bold strokes, instantly serving hopes and fears, while knowledge advanced by slow increments and contradictory witnesses." Acceptance of the current myth, if myth it is, could likewise hold up progress in cosmology for generations to come (p. 385).

So, based on the evidence, he apparently thinks that big bang cosmology is a myth. The second floor of this house of cards is fatally flawed, bringing all the floors above it (i.e., dark matter/energy in all its various forms) into question. The theory continues because there is no alternative in sight, which, the author says, is no reason to accept it (p. 384).

I suggest that the ground floor is also flawed. As Humphreys (1994) has shown, the same theory of general relativity with different initial conditions and/or boundary conditions leads to a very different result that not only explains the effects attributed to expansion but also results in a young universe as measured in earth time.

I wonder how much more could be accomplished if all of the effort of the cosmologists was directed at understanding the creation rather than searching for mythical origins.

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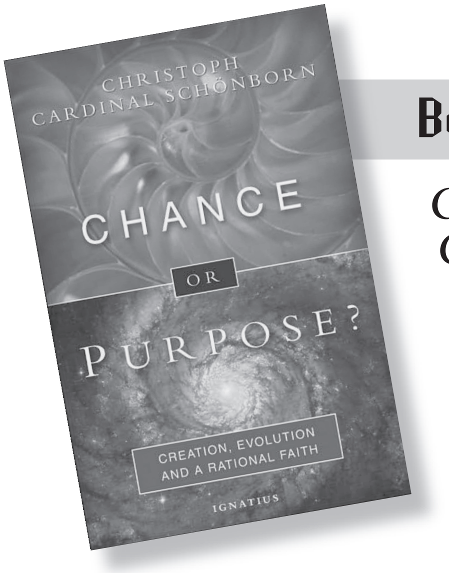

Book Review

Chance or Purpose? Creation, Evolution, and a Rational Faith

by Christoph Cardinal Schönborn.
Translated by Henry Taylor

Ignatius Press, San Francisco, 2007, 181 pages, $20.00 (hardcover).

This book is different. The well-known author, Christoph Cardinal Schönborn, is a recognized theologian and Archbishop of Vienna. During 2005-2006 the Archbishop gave monthly lectures dealing with "the theology of creation." The book grew out of those evening talks, which were based on the assumption "that theology and natural science do not contradict one another" (p.12).

The text supports the popular belief that the universe began with the big bang about 14 billion years ago. Therefore, "it is nonsense to maintain that the world is only six thousand years old" (p. 38). God used evolution in a Darwinian fashion to create the various forms of life. "Everything after its kind" in Genesis 1 is to be understood to mean "all kinds" (p. 53).

References include Roman Catholic evolutionists Stanley L. Jaki and Pierre Teilhard de Chardin. Even though many Bible passages are quoted, the thousands of prominent anti-Darwinian scientists and Bible scholars, as well as creationist organizations, virtually are ignored.

However, there is a commendable spiritual sensitivity expressed in this book. For example in the Conclusion, the author says, "'O Lord my God, thou art very great!' (Ps. 104:1). This wonder in our hearts must never die away" (p. 175). At the end of the text are a scriptural index and an index of persons. Notwithstanding its redeeming features, because of the parochial, one-sided nature of the book, I do not expect that it will have much impact, especially among scholars and other students seriously interested in origins issues.

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Submission

Submit an original plus two copies of each manuscript to the editor of the *Creation Research Society Quarterly* (see the inside front cover for address). Concurrent submission of an electronic version (Word, WordPerfect, or Rich Text Format) of the manuscript text and graphics is also encouraged. The manuscript and graphics will not be returned to authors unless a stamped, self-addressed envelope accompanies submission. Manuscripts containing more than 30 pages are discouraged. An author who determines that the topic cannot be adequately covered within this number of pages is encouraged to submit separate papers that can be serialized.

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Authors who are unsure of proper English usage should have their manuscripts checked by someone proficient in the English language. Also, authors should endeavor to make certain the manuscript (particularly the references) conforms to the style and format of the *Quarterly*. Manuscripts may be rejected on the basis of poor English or lack of conformity to the proper format.

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Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

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Walker, T.B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field. In 1996 the *CRSQ* was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

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2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

mammals

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